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A monthly magazine for members of Bell Telephone Laboratories, for their associates in the Bell System and for others interested in the progress of the communication art.

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The Cover—A beachmaster with a ten-million-fold amplified power of speech directs the seething complexity of landing operations on an enemy beach (see page 261).

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ADP and KDP Crystals

By W. P. MASON
Physical Research

OVER a hundred crystals are known to have piezoelectric properties but only quartz and Rochelle salt had been used in practice to a large extent until the present war. Stimulated by war applications, there has recently been developed a third crystal which may displace both for certain peacetime applications. This crystal is ammonium dihydrogen phosphate and it has been given the abbreviation ADP.

When a constant voltage is applied to a piezoelectric crystal, the crystal is deformed mechanically and charged electrically. This results from a change in alignment, under the influence of the applied electric field, of separated charges of positive and negative electricity in the crystal which are called "dipoles." Energy is thus stored in the crystal both in mechanical and electrical form and the ratio of the mechanical energy stored to the total electrical energy applied is measured in terms of a constant characteristic of the material which is called its electromechanical coupling. This is a direct measure of the efficiency of the crystal for converting electrical to mechanical energy under static conditions.

If an alternating potential is used, all of the electrical energy can be transformed into mechanical energy at the resonant frequency of the crystal, provided that its static capacity is tuned with an inductance. The electrical potential energy is converted into electrical kinetic energy and eventually into mechanical energy, if the mechanical load is the only source of dissipation. The frequency range over which the transfer can be made, however, is controlled by the electromechanical coupling in the crystal. If it is desired to transform electrical into mechanical energy, or vice versa, over a wide range of frequencies, electromechanical coupling is the most important factor.

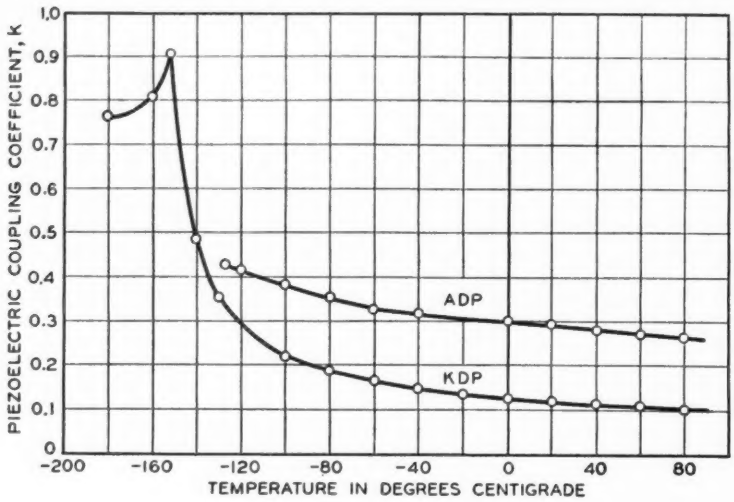


Fig. 1—The efficiency of a piezoelectric crystal as a direct-current converter of electrical into mechanical energy is measured by its coupling coefficient. For ADP this is approximately 0.3 *at ordinary temperatures, which means that about* 0.1 *of the electrical energy reappears in mechanical form*

headpiece. It is sixteen inches long and four inches square. Still larger ones have been grown there.

The ADP plate of principal interest made from these crystals is the so-called 45-degree Z-cut whose major surface is normal to the Z axis of the crystal and whose length is at 45 degrees to the other two axes. Figure 1 shows the electromechanical coupling for these plates and those of an isomorphous substance, potassium dihydrogen phosphate, KDP.

A different type of coupling, called ferroelectric from its analogy to ferromagnetism, appears in KDP at temperatures below —151 degrees C. At this temperature the positive and negative charges of the crystal dipoles align themselves along one of the axes of the crystal like the elementary magnets of a ferromagnetic material. This makes it possible for a small applied field to cause a considerable mechanical distortion. As in ferromagnetism,

ADP crystals provide high electromechanical coupling. They are free from nonlinear response and hysteresis effects and are very stable with temperature. ADP has no water of crystallization and hence will not dehydrate. Furthermore, it is stable up to temperatures as high as 100 degrees C., whereas Rochelle salt dehydrates at humidities below 35 per cent and disintegrates at 55 degrees C. For these reasons, ADP is largely displacing Rochelle salt in piezoelectric applications.

Crystals of ammonium dihydrogen phosphate were grown and their light transmission properties were studied as early as the middle of the last century. It was not until 1938, however, that the interesting dielectric properties of this and related crystals were realized. ADP crystallizes in the tetragonal scalenohedral class. A photograph of one of these crystals which was grown at our Murray Hill Laboratory is shown in the

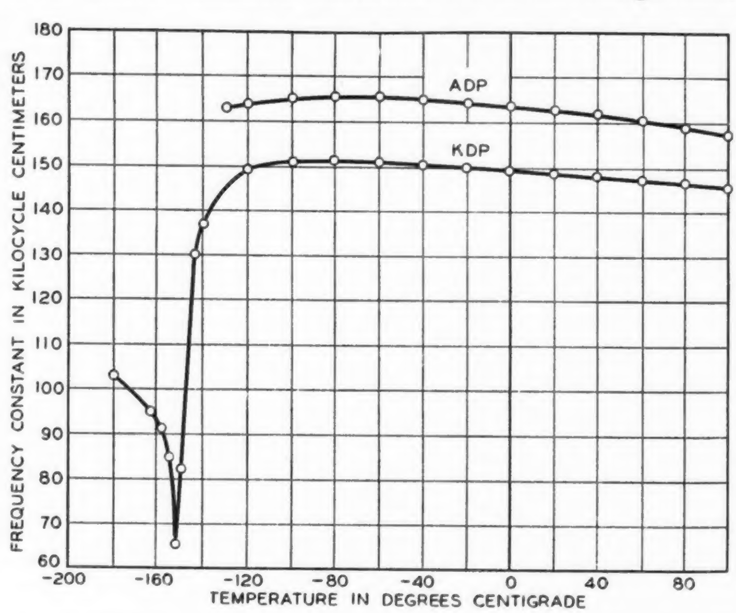


Fig. 2—Frequency constants of ADP and KDP plates, with variations in temperature. The dip in the KDP curve at —151 *degrees C. indicates the incidence of "Ferroelectric" coupling*

the response is not proportional to the applied field because there is hysteresis between polarization, lattice distortion and the applied field. The increased coupling of KDP at low temperatures is obtained only at the sacrifice of the stability of crystal performance with changes of temperature and field strength. Rochelle salt also provides a similar and better known example of ferroelectric coupling between —18 and +24 degrees C.

ADP on the other hand suffers a transformation at —125 degrees C. which causes the crystal to crack into minute fragments. This is not a ferroelectric transformation because, as is seen from Figure 1, the coupling coefficient does not change slope as the transformation temperature is approached. Figure 2 shows the frequencies of 45-degree Z-cut ADP and KDP plated crystals one centimeter long. Here again the elastic properties show a ferroelectric transformation for KDP but indicate no such change for ADP.

The ferroelectric properties of potassium dihydrogen phosphate have roused considerable theoretical speculation. Its crystal structure has been determined by X-ray analysis and the locations of the atoms in its unit cell are shown in Figure 3. The phosphate groups, PO_4, consist of a phosphorus surrounded tetrahedrally by four oxygens and are indicated by the tetrahedrons. Each phosphate group is surrounded tetrahedrally by four other phosphate groups. The positions of the potassium atoms in the crystal are indicated by the open circles. Those of the hydrogen atoms are not shown by X-ray analysis, but, according to Slater's theory, one is located somewhere on the connecting line between each pair of phosphate groups, forming what are known as hydrogen bonds. These bonds, as was first shown by studies of the structure of ice, sometimes permit the nucleus of the hydrogen atoms to shift from one to the other of two positions along the bond.

However, recent work which shows that the dielectric constant is unchanged with frequency up to 3 x 10^{10} cycles indicates that the position of the hydrogen bonds may be along the edges of the PO_4 tetrahedrons. In any case each H_2PO_4 group forms not only a negatively charged ion but also a dipole, and the shift in the position of the hydrogen nucleii, which are positively charged, causes a change in the direction of alignment of the dipoles from the Z axis to directions perpendicular to Z. The dielectric behavior of KDP indicates that the orientation of these dipoles along the Z (ferroelectric) axis must have a lower energy than at right angles to it. The spacing along the Z axis of the crystal is 6.97 Angstrom units, while that at right angles to it is 7.43 Angstrom units. This probably accounts for the lower energy along the Z axis. At very low temperatures all the dipoles must lie along the Z axis, since this is the position of lowest potential

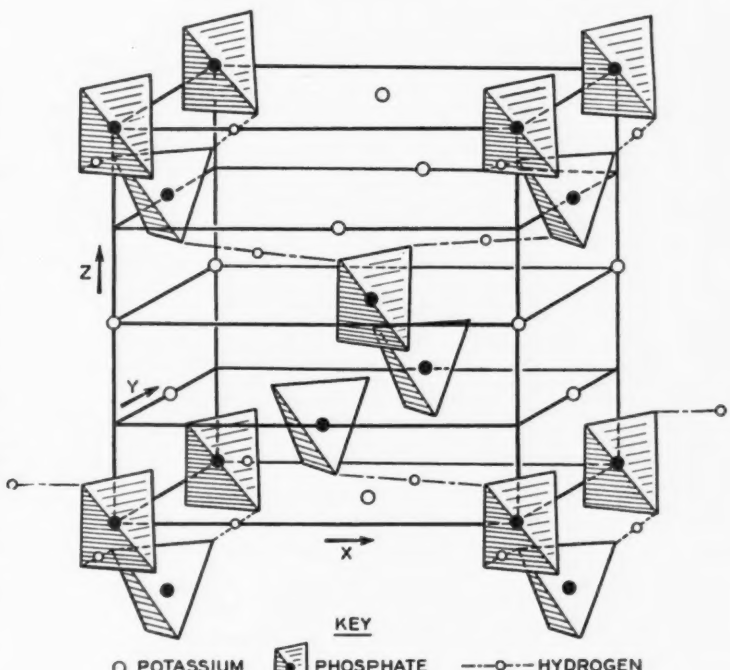


Fig. 3—Crystal structure of potassium dihydrogen phosphate. The dimensions of the unit cell are the same along the X and Y axes, 7.43 *Angstrom units, and* 6.97 *Angstrom units along axis Z*

energy. The crystal is then spontaneously polarized in a region or "domain," although neighboring domains may have the direction of polarization reversed. As the temperature rises, the hydrogen ions acquire a more random arrangement and some of the dipoles assume directions perpendicular to Z. When this condition occurs, the crystal loses its spontaneous polarization and is no longer ferroelectric.

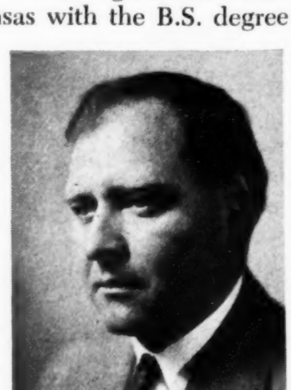
Measurements made by the writer have shown that the piezoelectric distortion, which is a shear, is directly related to the position of the hydrogen ions. When all the dipoles are lined up along the Z axis, a spontaneous shearing distortion of large magnitude occurs as well as spontaneous electric polarization. Above the point where spontaneous polarization disappears, an electric field applied along the Z axis causes more dipoles to point along that axis than in the other directions and polarization results. This is accompanied by a corresponding piezoelectric shear proportional to the number of dipoles aligned along the Z axis. The decrease of coupling with temperature, shown by Figure 1, is caused by the increased random arrangement of the hydrogen ions at the increased temperature, which makes it more difficult for an applied electric field to line up the dipoles along the Z axis.

In ADP an ammonium ion, NH_4^+, replaces the potassium ion of KDP and introduces the possibility of a new set of hydrogen bonds, one, as in KDP, and the other formed by the hydrogens of the ammonium being shared between the nitrogen ion N and the oxygens of the nearest PO_4 groups. On cooling to temperatures below —125 degrees C. some change, probably a rotation of the ammonia group, takes place in ADP which causes the crystal to shatter.

The dielectric and piezoelectric properties of ADP are probably controlled by the same H_2PO_4 bond system that is operative in KDP. The second set of hydrogen bonds in ADP more firmly knits the cell together and causes a larger change in shearing stress for a given dipole change than occurs in KDP which does not have the second set of bonds. The size of the unit cell has increased to 7.53 Angstrom units along the X and Y axes and 7.54 Angstrom units along the Z axis. This near equality of the edges of the unit cell indicates that the energy of the dipoles should be nearly equal for directions along Z and normal to it and hence the crystal should not be ferroelectric, a supposition that is borne out by the measurements. The principal piezoelectric distortion of ADP is a shear connected with an excess of dipoles along the Z axis and is directly proportional to the number of dipoles so aligned. Furthermore, the distortion for a given number of dipoles directed along the Z axis is over five times that for the same number of dipoles similarly directed in KDP. This accounts for the larger electromechanical coupling in ADP.

For ordinary temperature ranges, ADP has a larger electromechanical coupling than any other available non-ferroelectric crystal. It has already received large application in war equipment and will doubtless find extensive use in post-war commercial products.

THE AUTHOR: W. P. MASON graduated from the University of Kansas with the B.S. degree in E.E. in 1921 and joined the Laboratories that year. He received his M.A. degree in 1924 and Ph.D. in 1927 from Columbia University. Dr. Mason spent four years investigating carrier transmission systems and then became concerned with the development of transmission networks and in piezoelectric crystal research which have since occupied his time.



Beachmaster Announcing Equipment

By L. VIETH
Transmission Instruments Engineering

A PORTABLE high-power public address system that permits the raucous confusion of an amphibious landing to be dominated by the directing voice of the beachmaster talking from a point where the beach panorama is spread before him

AN INVASION beachhead in its early phases appears to be in hopeless confusion. Piles of equipment mount higher as each boat unloads its cargo. Landing craft bearing more machines and men move toward the beach from all directions, while unloaded craft miraculously find their way back to a mother ship for more cargo. As bulldozers clear paths for tanks and other vehicles pouring ashore in a seemingly endless stream, sounds of gunfire inland and airplanes overhead add to the confusion of mechanical noise and render the human voice puny and inaudible at all but the short distances.

Through all this turmoil and noise, strict control of the movements of troops and material must be maintained by the beachmaster, who—acting as traffic cop and dispatcher—directs the incessant flow of foot and mechanized power. His indispensable assistant in the later phases of the war was the Western Electric Beachmaster Announcing System, technically known as the Navy PAB-1 Public Address Set. But for this equipment, the voice of authority would be muted by the noise from the very machines and men it would keep in efficient order and deployment. Commands are instantly heard by all to whom they are directed, and there is no loss of time in relaying messages through a chain of command, which would be necessary with ordinary communication facilities.

Growing from experimental, small-scale use of loud-speaking equipment in early amphibious moves, the PAB-1 became available to the Navy early in 1944. It was

Fig. 1—The loud-speaker case

used for the landing at Iwo Jima and played its part in most of the Pacific landings after that. Thousands of these equipments were delivered to the Navy before the end of the war, and their applications have expanded far beyond original expectations. A close relative of the PAB-1 set is the Ship Mounted Landing Craft Control Announcing System (Navy IC Circuit 6 MC) whose major components are interchangeable with those of the former. Through the use of these two systems, direct two-way speech communication is possible between ships and shore.

Classed by the Navy as semi-portable equipment, the PAB-1 Public Address Set consists of a 250-watt loud-speaker, a 250-watt amplifier, a 1,500-watt gas engine driven alternator, and accessories and spare parts. The complete system is packaged as six individual units in rugged water-tight reinforced steel carrying cases with detachable covers. Each case is designed for its particular component and has ample buoyancy, so that if the occasion requires, it may be dumped overboard and floated ashore. The type of construction is evident from Figure 1, which shows the loud-speaker case with the cover removed. The loud-speaker itself is clamped to the bottom section of the case by corner brackets.

For the engine alternator, the four sides form part of the cover so that during operation the engine alternator is completely exposed. A different arrangement is provided for the amplifier because it is cooled by forced ventilation, and the cover must remain on the case. Two end doors are therefore provided, and these are opened during operation to expose the air intake and outlet ports and to give access to connections.

The loud-speaker is a 3 x 3 assembly of nine receivers coupled to nine horns and mounted on a yoke and tripod with extensible legs, as may be seen in the illustration on the front cover sheet and in the headpiece on page 261. It may be moved through a complete circle in a horizontal direction, and up and down from 30 degrees below the horizon to 80 degrees above it. This permits the sound to be directed readily toward various locations. The receivers are of the dynamic type used in practically all Western Electric speech range loud-speakers.* Blast valves are employed to protect the receivers from gun blasts.

The amplifier provides sufficient gain to produce an output of 250 watts from the normal output of the microphone supplied with the equipment. The power stage is single stage push-pull operated class B. The preliminary stages, which employ stabilized feedback, are built on a separate chassis which may be detached from the main body to make them more accessible for maintenance. A blower is provided for forced ventilation. Power for the amplifier is supplied by a gasoline engine driven alternator manufactured by the Homelite Corporation in accordance with Bell Telephone Laboratories specifications. An output of 1,500 watts at 115 volts, 60 cycles is available. When connected to the amplifier, which consumes about 750 watts, the engine alternator will run for about one and a half hours on a one-gallon tank of fuel.

The microphone is an electro-magnetic type similar to that used in battle announcing systems.† It is packed in the accessories case, which also encloses the connecting cables, ground rod, engine starting rope, and the loud-speaker yoke and tripod. Also in this case are emergency spare parts.

Since the PAB-1 Public Address Sets are frequently used at considerable distances

*Record, *June*, 1945, *page* 193. †Loc. cit.

from supply depots, more than the normal complement of maintenance spare parts is provided. These additional spare parts, which represent a miniature supply depot, are packed in two spare parts cases.

When ashore, the system may be set up within a few minutes by removing operating components from their cases, opening both end doors on the amplifier, assembling the yoke and tripod for the loud-speaker, plugging in cables between components, and starting the engine alternator. Only two controls are involved: the voltage rheostat on the alternator, and the amplifier gain control. A "magic eye" on the amplifier serves as a volume indicator, and enables the man at the microphone to adjust the gain as required. The system operates at ambient temperatures from —40 degrees F. to +130 degrees F. in heavy rain or when set up in mud or snow.

The useful range of the PAB-1 naturally depends on local conditions and will vary in different locations. When a greater area of coverage than that of a single system is desired, the unit nature of the components makes it possible to operate two amplifiers and loud-speakers from one engine alternator and one microphone. Similarly, for greater coverage, one microphone may be used to operate four amplifiers and loud-speakers powered by two engine alternators.

The system covers a frequency range of about 250 to 6,000 cycles, which is more than adequate for highly intelligible speech. Although frequencies in the range between 250 and 500 cycles contribute little to intelligibility in the presence of high ambient noise levels, they are of value when projecting speech over long distances.

After these Public Address Sets had done their part in helping to establish the beachhead, they would be moved on with the advancing troops or would remain to direct the continuing flow of supplies, machines, and troops. At forward command posts they were used for surrender demands and for conveying essential information to the troops when other means were either lacking or too hazardous to use. The compact, rugged, and reliable features built into this system, based on our wide background of telephone experience, enabled it to be used extensively throughout the combat areas. Its performance might well linger in the memories of those who have depended on it as the "Voice of the Pacific."

THE AUTHOR: L. VIETH was associated with transmission instrument development and design from 1919, when he joined the Laboratories, until 1928, when he transferred his activities to the development of sound recording and reproducing instruments. He later spent several years developing coin relays and associated apparatus, but with increased activity in our defense program he returned to acoustic work. During the war he was occupied exclusively with the development of high-power public address systems.

Fig. 2—Six cases house the complete PAB-1 Public Address Set

The 6AR6 Tube

By E. A. VEAZIE
Electronic Apparatus Development

IN CONNECTION with indicator oscilloscopes for certain airborne radar equipment under development for the Armed Services, an operating current of 450 milliamperes was required, and potentials as high as 1,250 volts were called for. This current was to be controlled by vacuum tubes, but the available space was extremely limited both in area and height. The smallest Western Electric tube electrically suitable was the 350A, and two of these tubes would be required to obtain the desired output. The available space, however, was inadequate for tubes of such size, and since no suitable tube of other manufacture was available, a new development was undertaken. The 6AR6 tube was the result. Two of these new tubes will supply the required current. Their size compared to that of the 350A tube (right) is shown in the photograph at the head of this article.

To secure a tube that would be physically small enough and at the same time meet the requirements for plate current and voltage, unusual care was necessary in the design of all of the tube parts and details. The desired objectives were attained in part by suitably combining design features and principles already developed and used in tubes for the telephone plant, such as the 374A tube which in external appearance is quite similar to the 6AR6. However, design innovations were necessary to overcome some of the special problems introduced by the new requirements.

One of the major difficulties arising from the combination of high voltage and small size was to secure sufficient separation of the electrode leads. Under ordinary conditions, the plate lead would have been taken through the top of the tube to secure a wide separation between the plate and all other terminals. This would require greater height, however, and additional separation would have been required between the top of the terminal and the housing. Considerable space would thus have been wasted. To bring the plate lead through a conventional glass press beneath the tube elements, on the other hand, was impossible since the small separation between leads would certainly result in arc-overs. Instead of a press, therefore, a glass dish construction which is similar to that of the 374A tube was employed. This permits much

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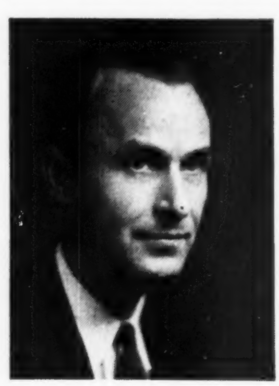
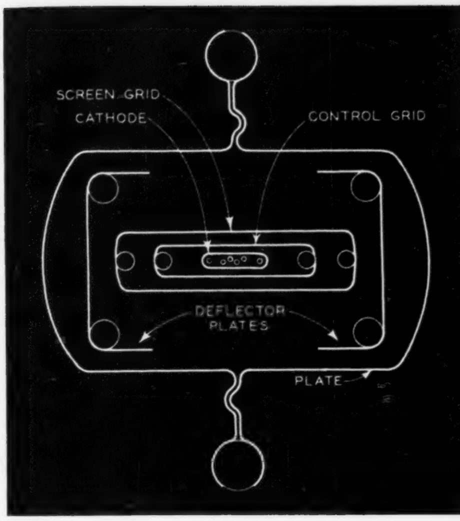
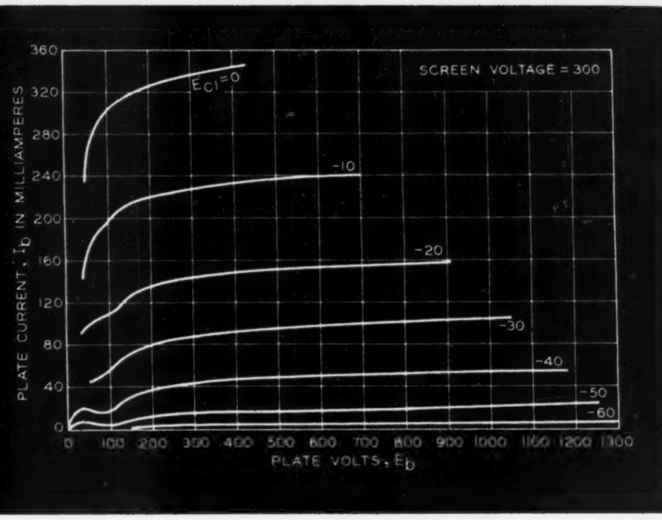
THE AUTHOR: Upon receiving the B.A. degree from the University of Oregon in 1927, E. A. VEAZIE joined the Technical Staff of the Laboratories. Here, with the vacuum tube development group, he engaged principally in the design of multigrid tubes for both low and high frequency uses. During World War II he turned his attention to tubes intended for military and naval application. Besides working on small tubes for airborne radar application, such as the 6AR6, he was also associated with studies and the development of various vacuum tubes for several other projects for the Armed Forces.





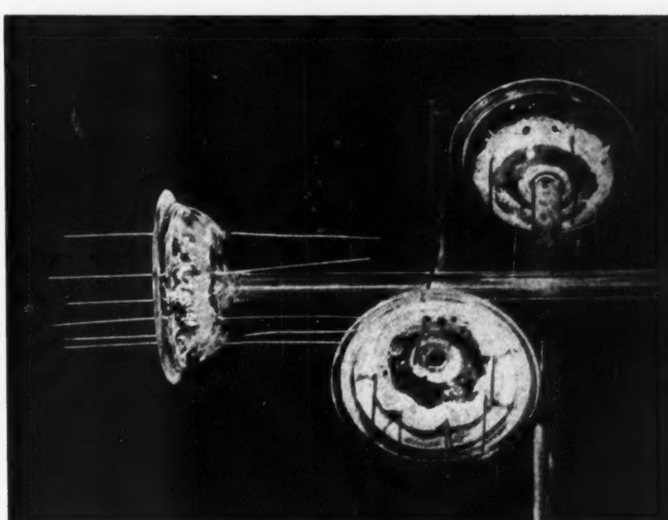


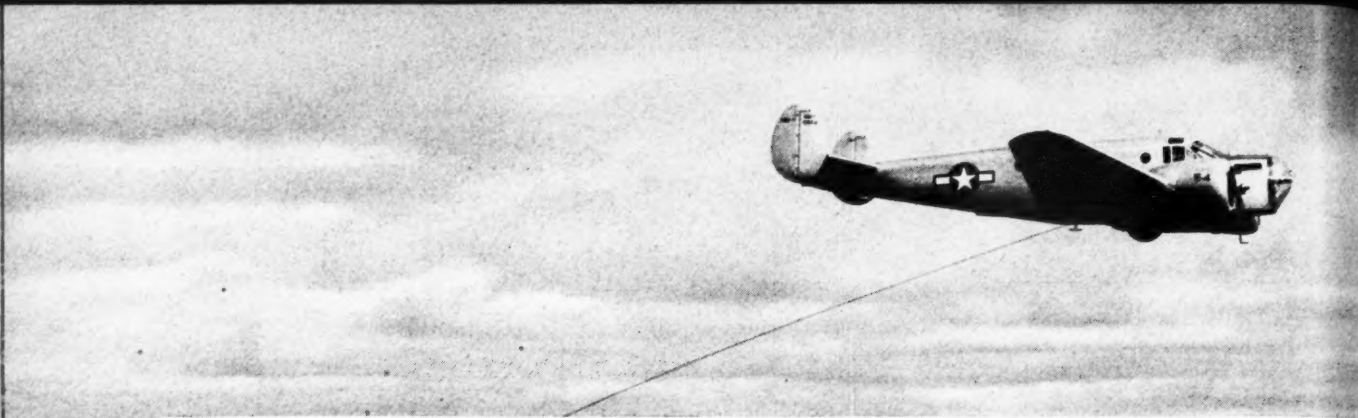
greater separation of the leads. In passing through the dish, and also through the base, the plate lead is kept ninety degrees from its nearest neighbors.

In general arrangement, the tube is a beam-power tetrode, with a cathode, control grid, screen grid, deflector plates, and plate. The arrangement of the elements is indicated above. To hold the screen current to a minimum, the lateral wires for the control and screen grids are wound with the same pitch and lined up so that each screen-grid wire lies in the electrical shadow of the corresponding control-grid wire. The electrical characteristics of the tube are shown in the illustration above.

In the apparatus for which the tubes were originally designed, high ambient temperatures had to be allowed for. Also, the tubes and other circuit elements dissipating considerable energy are confined in a very small space. As a result, cooling of the glass bulbs by forced circulation of air is necessary. Where the ambient temperature is more normal, however, and where the tubes are mounted in a reasonably open space, operation at the full plate dissipation rating of about twenty watts per tube is permissible and cooling by means of forced air is not required.

In passing through the glass dish the six leads are arranged in a circle so that if the position of the plate lead is called north, the two nearest leads would be 90° away at the east and west





Submarine Stalker Now Seeks Oil

A REVOLUTIONARY device for aerial prospecting for potential oil and mineral-producing areas has been developed as an outgrowth of a hitherto secret means of magnetically finding and tracking submerged enemy submarines.

In its wartime rôle, the magnetic airborne detector, familiarly known as "the aerial doodle bug" to those entrusted with its closely guarded secrets, has been credited with being an important weapon in the crucial struggle which was waged against enemy submarines.

In its peacetime application, the new device fulfills a long-standing dream of geophysicists in that it provides means for a quick large-scale survey of geological structure which scientists feel may be an important key to our natural resources. It is expected to be especially valuable in such now inaccessible areas as polar regions, jungles and offshore tidewaters.

The device was developed by Bell Telephone Laboratories in coöperation with the Naval Ordnance Laboratory under the auspices of the Navy's Bureau of Ordnance and Bureau of Aeronautics. Other magnetometers were developed by Gulf Research & Development Company, working independently and later under contract with the National Defense Research Committee, and by Columbia University Division of War Research through its Airborne Instruments Laboratory, also under contract with NDRC.

The method is considered so promising that those in charge of Naval Petroleum Reserves have employed it extensively in exploring for geological structures which may contain oil. Some 40,000 square miles in this country and Alaska, including part of the latter's Naval Petroleum Reserve Area No. 4, have already been mapped.

The instrument will also be used by the U. S. Geological Survey in mapping national resources and the U. S. Coast and Geodetic Survey has expressed the hope that further development might make possible the first really accurate magnetic map of the world.

Scientists associated with the development emphasized the reconnaissance nature of the device and pointed out that its chief value lay in its capacity to outline rapidly those areas which are promising, and which should be more intensively investigated by ground parties. In this connection, they pointed out that the magnetic airborne device does not actually detect oil deposits, but by mapping geological structures, indicates those areas in which oil is usually found.

The new device is the latest in a long list of wartime developments, such as radar, improved communications systems and computing machines, which although developed primarily for war, are expected to have widespread peacetime applications.

The principal feature of the new system is an airborne magnetometer, or "measurer of magnetism," which found great utility during the war because it could detect the great masses of iron in submarines when they were submerged too deeply for ordinary aerial observation.

Just how sensitive the device is can be appreciated from the fact that during the research a new employee of Bell Telephone Laboratories inadvertently caused considerable confusion when she neglected to mention that a small bit of sewing needle which had broken off in her finger some years before had never been removed.

Extreme precautions had to be taken throughout the researches, even to the ex-

Headpiece: Photo by Bureau of Aeronautics.

tent of using only brand-new, non-magnetic tools. At times the workers had to conduct their experiments in special clothing and in stocking feet, for some garments have metal accessories and shoes have nails. Even dirty finger nails have been known to disrupt the progress. Similar rigid precautions—almost surgical sanitation in effect—were observed in the production phase by the Western Electric Company, manufacturing associate of the Bell System, which produced several hundred systems for the Navy.

For its peacetime rôle, the Bell Laboratories-Naval Ordnance magnetometer was revised somewhat and combined with SHORAN, a radar mapping device developed during the war, and special mapping cameras under the direction of Dr. L. H. Rumbaugh, chief of the research department of the Naval Ordnance Laboratory. Geophysical applications have developed from plans worked out jointly by Dr. Rumbaugh and J. R. Balsley, Jr., of the U. S. Geological Survey of the Department of the Interior. Research and development work at Bell Telephone Laboratories was under direction of W. J. Shackelton, E. P. Felch and W. J. Means.

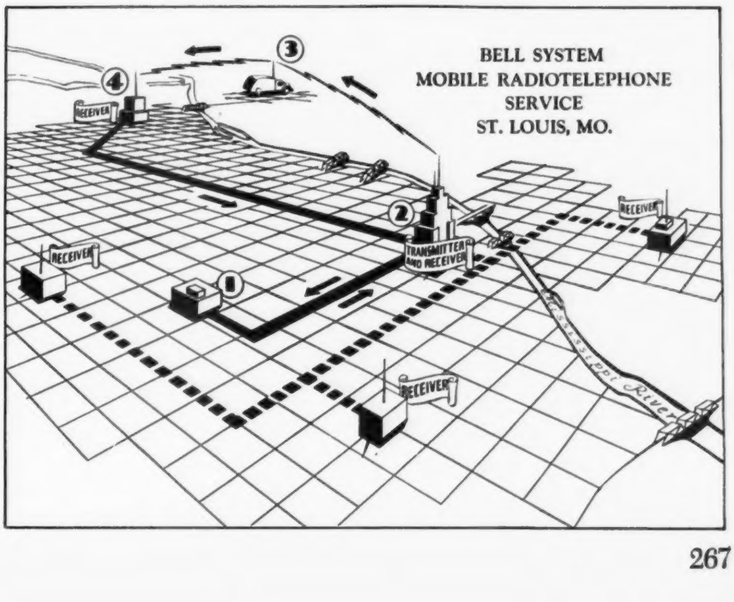
The first successful use of the new system of instruments occurred in tests conducted in Iron County, Michigan, and later in the Adirondacks in a search for iron ore deposits for war use. Subsequent tests indicated that in addition to its value as a speedy preliminary survey tool, the new device also gives a more accurate appraisal of the geological structure of an area than that obtained by ground parties using conventional methods of magnetic exploration. Another advantage of the new device is that it draws a continuous magnetic record of the terrain over which it is flown and in so doing disregards small and relatively unimportant magnetic irregularities.

The new instrument may also be used by oceanographers and geologists in the study of offshore geological conditions.

Telephone Service for St. Louis Vehicles

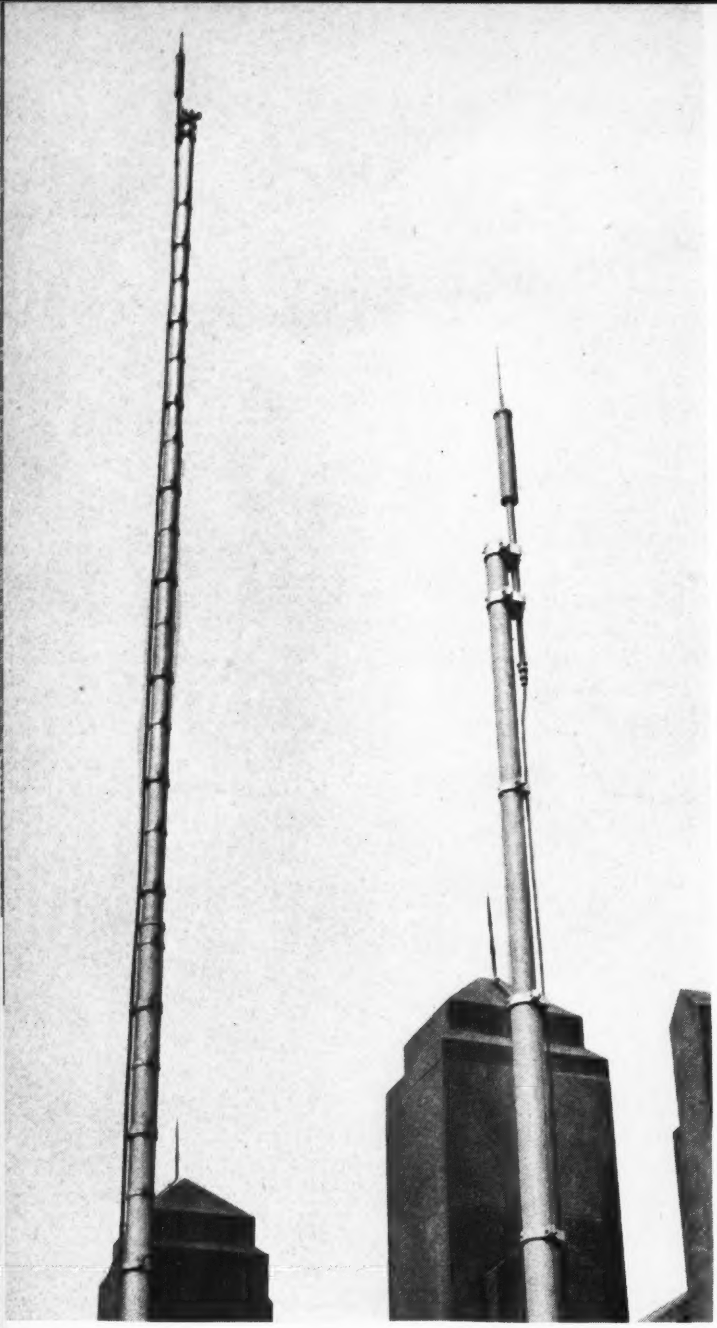
OPERATORS of motor vehicles in St. Louis are the first to have the opportunity to obtain two-way telephone service between their cars and trucks and any telephone connected with Bell System lines. The first license to operate radio-telephone service for vehicles has been granted to the Southwestern Bell Telephone Company by the Federal Communications Commission. The service has been provided on an experimental basis but under regular commercial conditions.

Participants in the trial are expected to include such concerns as parcel delivery



How Mobile Calls Are Handled
Telephone customer (1) dials "Long Distance" and asks to be connected with the mobile service operator, to whom he gives the telephone number of the vehicle he wants to call. The operator sends out a signal from the radio control terminal (2) which causes a lamp to light and a bell to ring in the mobile unit (3). Occupant answers his telephone, his voice traveling by radio to the nearest receiver (4) and thence by telephone wire.

To place a call from a vehicle, the occupant merely lifts his telephone and presses a "talk" button. This sends out a radio signal which is picked up by the nearest receiver and transmitted to the operator.



Transmitting and receiving antennas for the St. Louis mobile service

and express companies, newspaper publishers, power companies, contractors, bus, trucking and moving van concerns as well as oil burner, refrigeration and other servicing organizations which operate vehicles within the area and to whom keeping in touch with their drivers is important.

Three classes of service will be offered: (1) a general two-way telephone service between any vehicle and any regular telephone or other mobile unit; (2) a two-way dispatch service between a customer's office and his own mobile units only; and (3) a one-way signaling service to mobile units to notify the driver that he should comply with pre-arranged instructions.

The rates for a three-minute general service message within the area served by the St. Louis radio-telephone station range from 30 to 40 cents, depending on the location of the land telephone. The charge for a one-minute two-way dispatch call is 15 cents. The rates for most calls will not vary within the location of the vehicle. If the calling or called land telephone is outside the St. Louis mobile service area, toll rates apply.

The radio equipment on the vehicle may be provided either by the customer or the telephone company. If furnished by the company, the monthly service charge is $15 and an installation charge of $25 applies.

Equipment to be installed in the cars and trucks consists of a radio receiver and transmitter, antenna, selective signaling device, and telephone instrument. The instrument, which will be similar to a regular hand telephone, will be mounted on or under the dashboard, within easy reach of the occupant. The transmitting and receiving units, having power of about 20 watts, will be located in the trunk of a car or in any suitable place on a truck. Each of the two units will be contained in a steel case approximately 10″ wide, 18″ long and 8″ deep, and each will weigh about 40 pounds. The single antenna for both sending and receiving will be approximately 18″ in length, mounted on top of the vehicle.

The radio-telephone central office equipment employed in St. Louis includes a transmitting station and five receiving stations. The antenna of the 250-watt transmitter is located on a 50-foot mast atop the Southwestern Bell headquarters building at 1010 Pine Street. The receiving stations are located in various sections of the city so that vehicles with their relatively low-powered radio sets will be within range at all times. The receiver nearest a calling mobile unit will pick up the voice signals and send them on their way by telephone wire. Radio channels within the frequency range of 152-162 megacycles have been assigned for the service.

St. Louis is the first of a large number of cities in which the Bell System plans to inaugurate mobile radio-telephone

service this year. Such a large undertaking requires extensive planning and development in which the Laboratories is very active. In addition, our engineers and facilities are playing a large part in putting the early systems into operation. The project as a whole is under the direction of M. B. McDavitt of Transmission Engineering, with A. C. Peterson and D. Mitchell as supervisors. Engineers from other departments are W. G. Schaer and J. H. Craig who handle equipment problems on the control terminal.

Rural Radio Trial in Colorado

THE VICINITY of Cheyenne Wells, Colorado, with its scattered ranches, has been chosen by the Bell System as the area in which the practicability of furnishing rural telephone service by radio will be tested under actual operating conditions this summer.

Authorization to establish the necessary radio facilities at Cheyenne Wells and at the ranches involved in the test has been granted by the Federal Communications Commission to The Mountain States Telephone and Telegraph Company, which serves that section. Installation of the system is now under way. The equipment has been developed by the Laboratories.

Cheyenne Wells, center of the area selected for the experiment, is in eastern Colorado, near the Kansas border. The eight ranch families who will participate in the trial live in widely separated locations 11 to 21 miles from the town and are not reached by either telephone or power lines. The power needed to operate the subscribers' radio equipment will be obtained from their home electric plants.

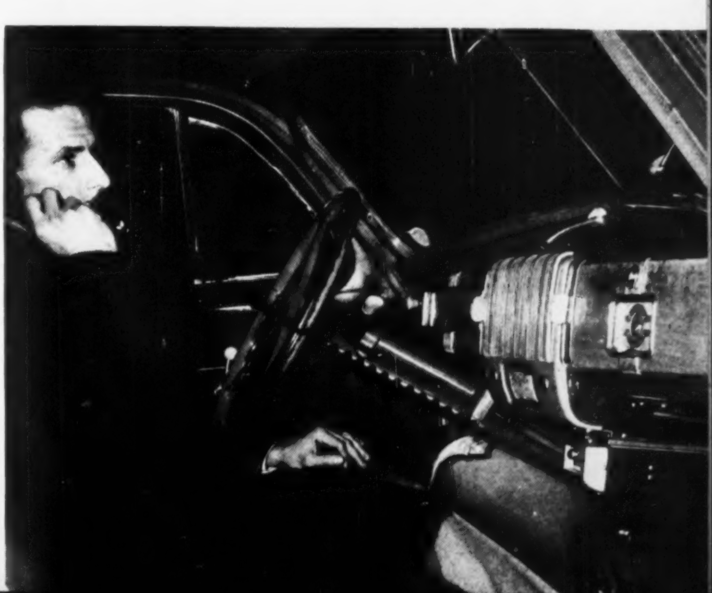
Four of the ranches will be served by direct radio links to the telephone central office in Cheyenne Wells. The other four will be reached by comparatively short wire lines extending from one of the nearby ranches having radio-telephone equipment, through which they will be connected with the central office. By means of this radio and wire combination, the telephones at the ranches will be joined to form an eight-station "party line" terminating at the Cheyenne Wells switchboard in much the same manner as conventional rural lines.

Radio-telephone equipment at each of the four ranches will include a receiver, a transmitter, a telephone and two antennas. The transmitter, having power of about ten watts, and the receiver will be enclosed in a steel cabinet which can be located out of sight, with only the telephone instrument in view. The antennas will be mounted on a pole or atop one of the ranch buildings.

At the central office in Cheyenne Wells there will be transmitter and receiver equipment and apparatus required to connect it into the regular telephone system. The equipment will operate on frequencies between 44 and 50 megacycles.

In order to gain experience without delay, the trial is being conducted with modified apparatus originally designed for other purposes. It is expected that the operating experience gained in Colorado will aid the Laboratories in developing a standard rural radio-telephone system especially designed to meet the requirements of this service.

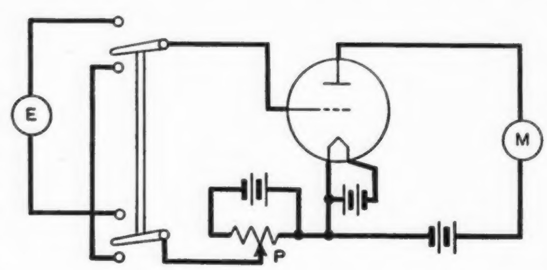
The Laboratories' project engineer on this trial is S. B. Wright, assisted by V. A. Douglas, H. W. Nylund, W. J. Hicks, Jr., S. Duma, and G. V. Lago. Others associated with the project are: antennas, W. C. Babcock; power, F. W. Anderson, R. W. DeMonte, M. V. Hunter, L. W. Kirkwood, E. A. Potter, W. S. Ross, J. R. Stone and D. E. Trucksess; signaling, B. McWhan; equipment, J. H. Craig; telephone sets, C. A. Johnson, Jr.; radio-frequency coils, L. B. Hilton, B. Slade and G. F. J. Tyne; and condensers, J. A. Normann, R. E. Drake and M. Whitehead.



Typical car equipment for St. Louis mobile radio-telephone service

Historic Firsts: Vacuum-Tube Voltmeter

By 1915, instruments for measuring d-c voltage were very satisfactory, and were available in a wide variety of forms. Instruments for measuring a-c voltage at frequencies used in the power field were also available, although perhaps not quite so satisfactory as the d-c instruments. Measurements of voltage at high frequencies, however, were much more difficult to make. Hot-wire or electrostatic types of instruments were generally required, and these lacked the simplicity and practical precision of the electro-dynamic meters except under controlled laboratory conditions. Careful calibration was required before dependable readings could be obtained. A disadvantage of practically all types of commercial voltage-measuring devices was that they drew appreciable current from the source being measured. Since most of the high-frequency voltage measurements were made on circuits of high impedance, even the small current taken by the measuring instrument disturbed the circuit, and affected the accuracy of the reading.



At that time, R. A. Heising was actively engaged in radio-telephone developments, and was badly in need of an instrument that would easily and accurately measure voltages at the radio frequencies. The high-vacuum electronic tube had recently been developed by Arnold* and had been employed for transcontinental wire telephony. Heising's familiarity with the characteristics of this tube enabled him to perceive that it could be adapted to the measurement of voltage, and in September, 1915, he applied for a patent on a thermionic voltmeter. Patent No. 1,232,919 covering such a device was issued in 1917, and reissued in 1922. Since that time, the vacuum-tube voltmeter has become probably the most widely employed instrument in the radio field. With the development of carrier transmission, and the widespread application of higher frequencies to wire communication, the field of the vacuum-tube voltmeter was further broadened, and today it is indispensable in all electrical communication work.

When the grid of a three-element vacuum tube is negative, no appreciable current will flow in a circuit connected between the grid and the filament. Expressed in another way, the impedance across the grid and cathode under these conditions is extremely high—infinitely high in the ideal case. Moreover, when the grid is sufficiently negative, no current will flow in the plate circuit either; and with any value of grid voltage, the current that flows in the plate circuit is unidirectional, and thus may be measured with a simple d-c meter. These are the characteristics that Heising took advantage of in inventing the vacuum-tube voltmeter.

With the circuit shown, E is the source of voltage to be measured, and P is a potentiometer with which any desired percentage of the battery voltage may be applied to the input circuit. The potentiometer may be given a calibrated scale so that the applied voltage may be read directly. To make a measurement of voltage, the switch at the left is first moved to the lower position, and the potentiometer is turned until the meter M just shows zero current. The switch is then moved to the upper position. If E is an alternating voltage, the current that flows in the plate circuit is related to the average value of the positive half cycles. The potentiometer is now moved until once again the meter indicates zero current. Under these

(*Continued on page* 274)

*Record, *May,* 1943, *page* 283.

Communications in Germany

By PIERRE MERTZ
Transmission Engineering

GERMANY'S principal cities were connected by a network of coaxial cable designed to handle two hundred simultaneous telephone conversations plus one television program in each pipe.

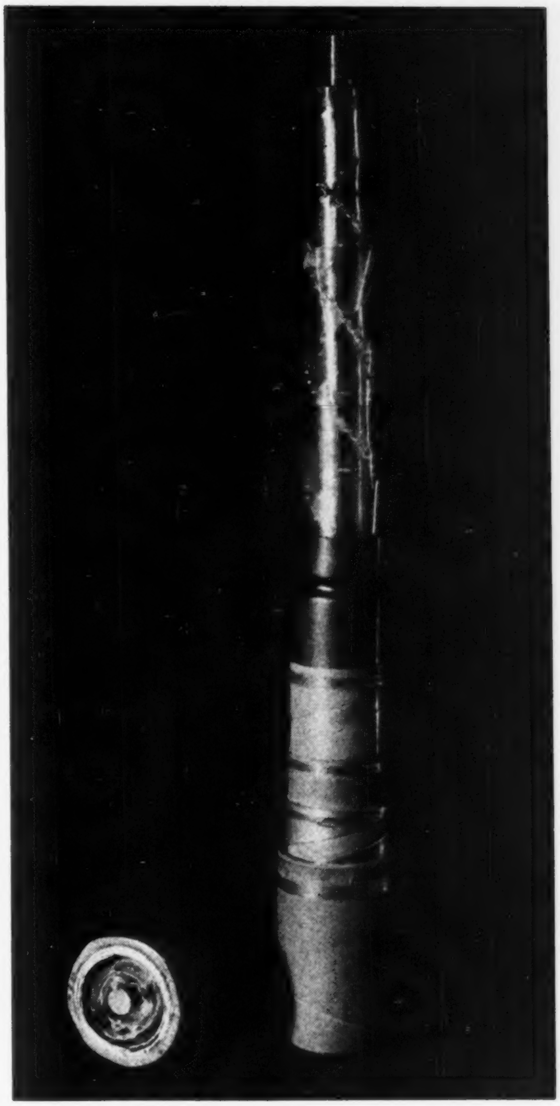
The Germans had set up an extensive wire broadcasting system providing three programs led into the home by carrier over the regular telephone channels and tied into the home radio receiver.

Some of their component designs were in advance of ours. Much of their system's planning was patterned after and somewhat behind ours.

These items reflect the findings of a six-week tour of Western Germany's communications facilities, factories and laboratories from June to August 1945. J. R. Townsend, also of the Laboratories, R. H. McCarthy of Western Electric, and I were members of an American-British delegation sent by the Technical Industrial Intelligence Committee of the Combined Intelligence Objective Subcommittee to study developments produced by German science before and during the war.

We visited—among other places—Hamburg, Nordenham, Frankfurt, Nuremberg, Munich, Konstanz, and Cologne, talked to many specialists, and inspected operating plant and manufacturing sites. The state of destruction, by now fairly well known, was new to us. Factories producing communications equipment, we learned, were partially but not completely destroyed. Many were in relatively good shape and a substantial number were repairable. The Germans had located numerous communications stations and factories underground and these were little or not at all damaged. Centers of large cities were, in many cases, completely obliterated by bombing, but since factories were usually located in the suburbs, they often suffered less damage.

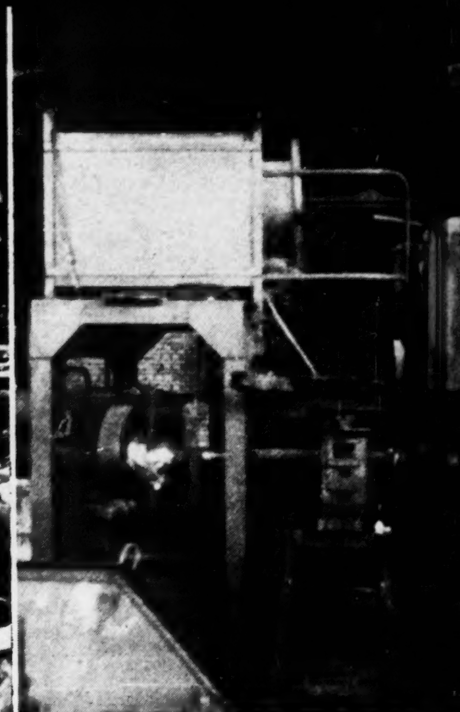
German communications were owned, operated and maintained by the government. Equipment manufacture, including cable, was concentrated in a relatively few private concerns which, however, had many branch offices and subsidiaries. Significantly, university professors were employed to a large extent by private concerns as consultants on industrial problems.



A section of German coaxial cable, showing elaborate use of styroflex insulation to suspend the central conductor in the pipe

As mentioned, the civilian system included a broadband cable network for multi-carrier telephone and television between the principal cities. The telephone equipment for this network was in place and was said to be operable although it was not in use due to difficulties involved in

Bombs have ripped apart this section of a cable factory in Osnabruck, Germany



Some other sections of th sa
damaged. This is a ble

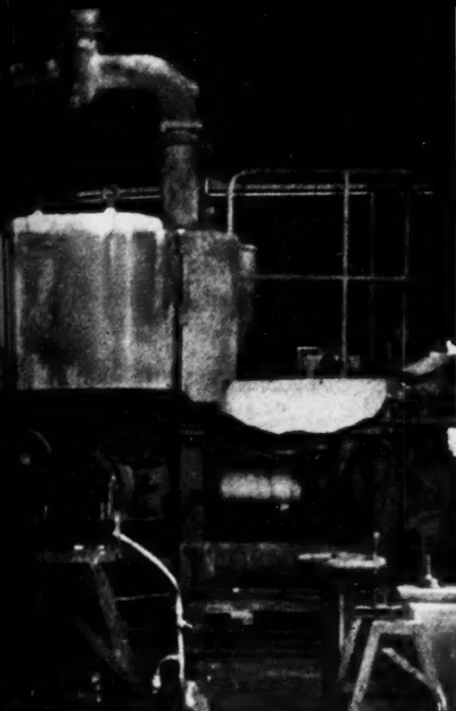
crossing occupation zone boundaries. No high definition television had ever been carried on the network except over the very short distance from Berlin to Brocken on Berlin's outskirts. The intermediate television repeater stations spaced halfway between the carrier telephone stations, which were placed at 35-kilometer intervals, had been installed but never connected with the circuit. The coaxial pipes were somewhat larger than ours to give less attenuation at higher frequencies, and styroflex insulation had been used extensively. There was a fairly dense network of more conventional toll cables, mostly underground, and some open wire. To this network, military communications had added field open-wire circuits designed for multi-channel carrier operation, and some short-wave radio.

Many types of civilian carrier systems had been developed, most common of which was a "two-band" circuit with a carrier band immediately above the voice band frequencies. The total spread of the two bands was 6 kc and they were handled as a pair throughout the entire transmission path. No obvious precautions had been taken to prevent crosstalk between the two channels. There were also infrequent extensions of this system by superposition of higher frequency channels immediately above the two bands. Complete systems of eight and fifteen channels, and, of course, the two hundred channel coaxial circuits, had also been developed. Some German engineers seemed to think the fifteen and two hundred channel circuits too complex for practical operation.

Voice frequency program circuits to interconnect radio stations were included in the German communications networks and differed not radically from ours. The wire broadcasting channels mentioned previously which led directly into the home via telephone channels were also provided. Through modification, radio sets could be adapted to receive the program.

German workmanship tended to be good with the emphasis on durability rather than speed and simplicity in manufacture. A considerable number of plug-in contacts were used, which provided flexibility but which we might consider undesirable from a noise standpoint. Vacuum tubes, produced extensively in underground factories, had been so standardized that large quantities were made of a very few types.

Shortages of both materials and time affected German products. Aluminum wire was replacing copper wire even to the point where it was planned as a substitute in new broadband cables. Lead sheathing for cables was almost paper thin and was supplemented with a heavy covering of impregnated paper, steel wire and tape. Some military cable had been so hurriedly made



same factory were little le extruding machine

With slight repairs, this wire-drawing machine can begin producing again—Photos by J. R. Townsend

that it consisted merely of paper-insulated pairs tied together with cord, and with no outer covering at all. Heavy fighting that surged back and forth at Julich littered the ground with what seemed like cobwebs of cable, which included much of this temporary type.

Die castings were prominent in radio equipment manufacture. Near Stuttgart we saw a factory especially designed to handle large size and complex castings for radio set chassis. Among components to which the Germans gave particular attention were condensers. They had a process for vapor deposition of metal on the dielectric for weight-saving and self-healing properties, and another for extrusion of styroflex into thin sheet material as a substitute for mica or paper. This latter product appears useful not only for condensers, but in cables and other high-quality dielectric applications. They had also found a process for saving silicon in the production of crystal rectifiers by vaporizing silicon on carbon. The rectifiers were designed for radar use and appeared to have properties not too different from ours.

Little was learned about German propagation studies. It was found, however, that the Reichsanstalt (German Bureau of Standards) had measured the properties of a variety of materials to waves ranging from 3.5 mm to 50 cm and that low power, continuous wave magnetrons had been developed for use in the shorter wave measurements.

Television specialists interviewed said they had been principally concerned with development of a large-screen projector system and high definition running up to 1,000 lines, before the war transferred their

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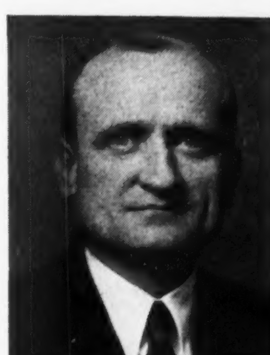
THE AUTHOR: PIERRE MERTZ received the A.B. degree from Cornell University in 1918. A year later he joined the Department of Development and Research, where he engaged in transmission studies. In 1923 he left to continue his studies, and after receiving the degree of Doctor of Philosophy, also from Cornell University, he returned to the Department of Development and Research. With the consolidation of the Department of Development and Research and the Laboratories in 1934, Dr. Mertz came to West Street, where he has been engaged in transmission problems relating to telephotography and television. During the war he was associated with special problems in radar and with the N.D.R.C., and after V-E Day visited England, France, and Germany as scientific consultant for T.I.I.C.



attention to military applications. Small and simple transmitters for guided missiles had been turned out but never used significantly in combat.

Photosensitive surfaces, photoconductive materials, and materials whose dielectric constant changed with light seemed of particular interest to the Germans. A photocathode used as an image tube in converting an infra-red beam into a luminous picture on a fluorescent screen had been brought to the point where fairly good quality pictures were obtained. They had developed fluorescent screens for radar and other devices in which a thin metal coating was applied to the tube over an organic coating which was later removed by heating. The metal coating permitted higher voltages for the cathode ray beam exciting the fluorescence, and resulted in a greater contrast range in the image.

Medal for Merit Awarded to F. B. Jewett

Secretary of War Robert P. Patterson presented the Medal for Merit to Dr. Frank B. Jewett for his outstanding services in World War II at a ceremony in the Pentagon Building on June 7. The citation accompanying the award, signed by President Truman, follows:

"Doctor Frank B. Jewett, for exceptionally meritorious conduct in the performance of outstanding services to the United States, as a member and President of the National Academy of Sciences since July 1, 1939, and a member of the National Defense Research Committee since July 27, 1940. Doctor Jewett was instrumental in aiding many of the technical services of the War Department by establishing within the National Academy of Sciences advisory panels comprehensively covering particular fields of science. This Army-civilian coöperation which was encouraged by Dr. Jewett aided immeasurably in solving many of the technical problems confronting the agencies of the War Department. Because of his position, Dr. Jewett was very instrumental in the organization of the National Defense Research Committee and aided immeasurably in initiating that Committee. His interpretation of pure science from a world point of view and his knowledge of the fundamental sciences contributed greatly to the technical superiority of the Allied Forces."

K. E. Gould Goes to Japan

To help direct the rehabilitation of Japan's war-damaged communications facilities, a group of Bell System specialists has sailed for Tokyo in response to a request for assistance from Secretary of War Robert P. Patterson.

These telephone men, whose assignment as members of the Civil Communications Section under General of the Army Douglas MacArthur will continue for one year, will spearhead the Army's program for speeding up factory production and installation of facilities needed for replacement of bomb-damaged and worn-out telephone equipment.

The group, including K. E. Gould of Transmission Development, will be primarily supervisory and advisory in character and will be aimed at bringing Japan's communications up to a standard which will meet the requirements of the occupation forces, and at the same time permit restoration of service sufficient to meet the reasonable needs of the Japanese people.

Historic Firsts

(*Continued from page* 270)

conditions, the peak value of the a-c voltage is just equal to the difference between the two settings of the potentiometer. Had E been a d-c voltage, an identical procedure would have been followed.

This circuit illustrates only one of many ways in which the vacuum tube may be used for measuring voltage, and other ways were indicated in Heising's patent. The basic principle claimed is that of balancing the voltage to be measured by an adjustable known voltage in the input circuit of a thermionic rectifier, the condition of balance being ascertained from a current-indicating instrument in the output circuit.

This fruitful suggestion for a method of measuring voltage, either d-c or a-c of any frequency, without taking current from the measured source and without requiring preliminary calibration, has proven indispensable in developing radio and other communication circuits ever since that time. Today, commercial vacuum-tube voltmeters are available in a wide variety of forms, and no laboratory is without them.

Ralph Bown Now Director of Research

Effective June 3, Ralph Bown was appointed Director of Research reporting to M. J. Kelly, Executive Vice President.

Dr. Bown, internationally recognized for pioneer research and development work in the broad field of communication engineering, has been associated with the Bell System since 1919. He served as President of the Institute of Radio Engineers in 1927, in which year the Institute also honored him with the award of its Morris Liebmann prize in recognition of his distinguished researches into wave transmission phenomena. He was a division member and consultant of the National Defense Research Committee, specializing in radar, and in 1941 he was sent to England by the United States Government to study radar operation under combat conditions. He has also served as expert consultant to the Secretary of War.

During World War I, Dr. Bown was officer in charge of radio development work at the U. S. Army Signal Corps Radio Laboratories at Camp Alfred Vail, N. J., where he participated in early experiments in communications between aircraft and ground by radio-telephone.

Upon discharge from the Army, he joined the D & R where, until 1934, he investigated various aspects of radio broadcasting and ship-to-shore and overseas telephony. At that time he was appointed Associate Director of Radio Research for the Laboratories, and three years later he was named Director of Radio and Television Research, and more recently, Assistant Director of Research.

RALPH BOWN, *Director of Research*

James W. McRae Advanced

Also effective June 3, James W. McRae was appointed Director of Radio Projects and Television Research reporting to Dr. Bown. He continues his duties as Electro-Visual Research Engineer.

Dr. McRae has recently been released from active duty as a Colonel in the Army Signal Corps, where his last assignment was as Deputy Director of the Engineering Division of the Signal Corps Engineering Laboratories. He was previously associated with the development of airborne radar and radio and radar countermeasures, and at one time he served as Acting Chief of the Electronics Division in the Office of the Chief Signal Officer. He has been awarded the Legion of Merit.

Dr. McRae became associated with the Laboratories in 1937 when he undertook research on transoceanic radio transmitters at the Laboratories' Deal, N. J., location. In 1940 he turned to a study of microwave techniques, especially their use in radio relay systems, and, with the approach of war, to the construction of a microwave communications transmitter for the National Defense Research Committee. This was followed by a general study of radar possibilities and subsequent investigation of microwave radar components.

A native of Vancouver, British Columbia, Dr. McRae attended the University of British Columbia, receiving the degree of Bachelor of Applied Science in Electrical Engineering in 1933. He received his master's degree from the California Institute of Technology in 1934 and his doctorate from the same institute in 1937.

Honorary Degrees

In recognition of his outstanding contributions to communication engineering, M. J. Kelly, Executive Vice President, was awarded the honorary degree of Doctor of Science by the University of Kentucky on June 7. The citation read:

"Eminent physicist. Member of the National Academy of Sciences. Director of Research and more recently Executive Vice President of world's largest communications laboratory. During the war years, under his dynamic leadership, this laboratory made important contributions to our victory in the development of radar and many other new electronic instruments of war for our Army and Navy.

"The University of Kentucky is proud to welcome back to its campus one of its old students and a former faculty member who has brought honor to the institution and to confer upon him the Degree of Doctor of Science."

This is the second honorary degree which Dr. Kelly has received. In 1936 he was made an honorary Doctor of Engineering by the School of Mines and Metallurgy of the University of Missouri.

The Doctor of Science degree was conferred on C. N. Hickman for his work on rockets and recoilless guns by Clark University on May 26. His citation, in part:

"In 1940, inspired by another distinguished Clark alumnus, Dr. Robert H. Goddard, with whom he had worked and demonstrated rockets in 1918 at Aberdeen Proving Ground, he set in motion the machinery which resulted in the creation of a section of the National Defense Research Committee for the development of rocket weapons.

"Appointed chief of this section, in addition to his administrative duties, and in coöperation with the Armed Forces, he was responsible for the technical design of recoilless guns, launchers for bombs, and of many rockets including the famous bazooka target rocket. He also developed the ribbon frame camera and other apparatus and special techniques necessary for the study of internal and external ballistics of rockets."

Columbia University conferred the degree of Doctor of Science on T. E. Shea, who, for many years, was a member of the Technical Staff of the Laboratories. The citation read:

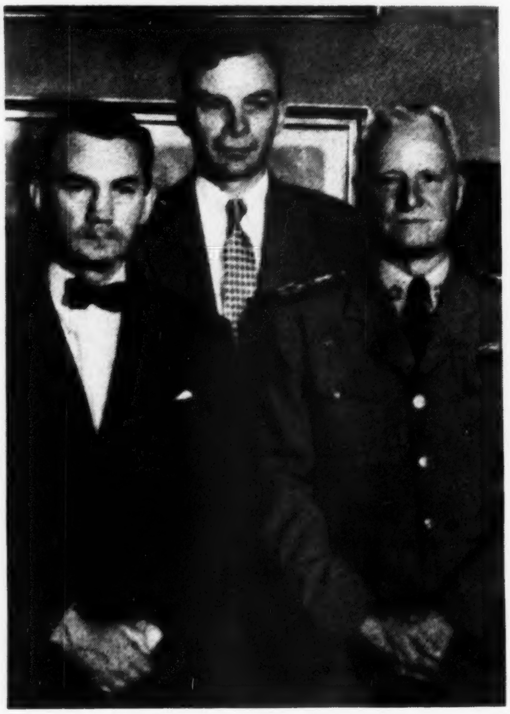
"Engineer; noted for research in the fields of electrical networks and communications equipment; responsible for the development of submarine devices during the war; displaying in that connection the highest qualities of leadership in administration and initiative in research; one of 'those rare intelligences, active, alert, inventive.' "

Dr. Shea has been on leave of absence from Western Electric to Columbia University as Director of Research on Subsurface Warfare. He was also a member of N.D.R.C.'s Division 6. Now he has returned to the Western Electric Company as superintendent of manufacturing engineering, Electronics Shops.

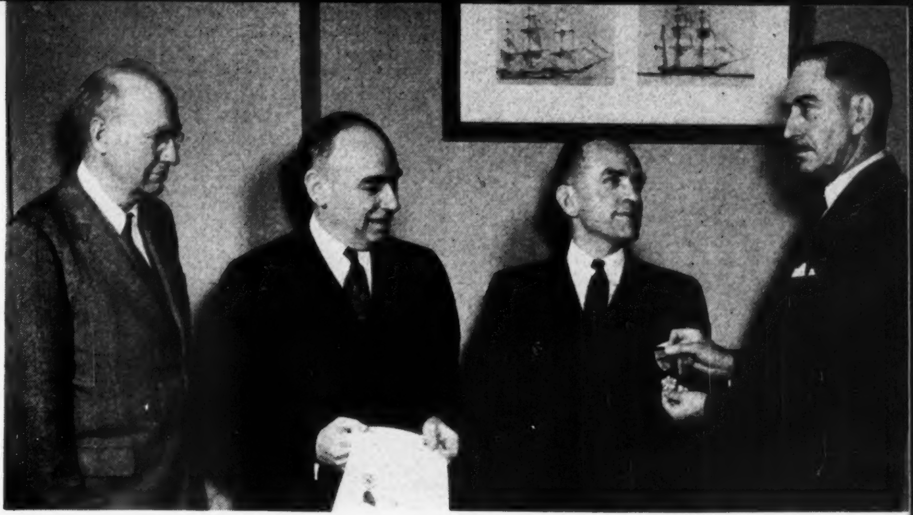
Dr. Shea, at a ceremony in Washington on May 31, also received the Medal for Merit from the Navy for his contributions to the underwater sound detection.

C. F. Wiebusch Receives Medal for Merit

The Medal for Merit was presented to Charles F. Wiebusch at a group ceremony in Washington on May 31, following which the recipients were congratulated by Secretary Forrestal and Admiral Nimitz. Also



At the ceremony honoring a group of scientists who received the Medal for Merit—Secretary of the Navy James Forrestal, Charles F. Wiebusch and Fleet Admiral Chester W. Nimitz—U. S. Navy Photo



Brigadier General C. O. Bickelhaupt presents the Legion of Merit to Colonel Andrew W. Clement for his "outstanding technical ability and judgment in the development, modification and test of radar and other electronic equipment." O. E. Buckley and Morton Sultzer are at the left. The complete citation was given in the last issue of the RECORD

recipients of the medal were Dr. R. D. Mindlin of Columbia University, who, during part of the war, was a member of Electronics Development, and continues as a consultant on mechanical engineering; and Dr. T. E. Shea, a former Laboratories engineer, now with Western Electric.

Mr. Wiebusch's citation, signed by the President of the United States, reads:

CHARLES F. WIEBUSCH, for exceptionally meritorious conduct in the performance of outstanding services in furtherance of the war efforts of the United States, while serving on the technical staff of the Bell Telephone Laboratories from 8 July 1944 to 24 May 1945. Under his brilliant and inspiring leadership, the activities under his direction worked in closest coöperation with responsible naval activities ashore and submarine forces afloat, and designed, produced, and installed many devices which have enhanced, to a tremendous extent, the offensive and defensive potential of submarines of the United States Fleet in their highly successful campaign against the enemy. This action on his part is in keeping with the highest traditions, long since established by the patriots of the United States of America.

Lieut. Tuttle Wins Swope Award

Lieut. D. F. Tuttle, Jr., has been awarded a Gerard Swope Fellowship, it has been announced by the General Electric Company. Lieut. Tuttle, who is studying for his doctorate at M.I.T., served the Navy on radar duty in the Pacific, returned and was reinstated at the Laboratories, and was then granted a leave of absence. The Gerard Swope Fellowships are awarded annually to college graduates in electrical engineering "who have demonstrated outstanding abilities in the field of engineering and research."

Greater New York Fund

Members of the Laboratories contributed $10,128.65 to the 1946 Greater New York Fund during its ninth annual campaign. The money will be used for the support of 415 hospitals, health and welfare organizations, all of which administer to New Yorkers, regardless of race or creed.

Railroad Radio Telephone Tested by Northern Pacific

During March and April railroad radio tests were made by Bell Laboratories and Western Electric engineers in coöperation with the Northern Pacific Railway. The equipment consisted of Western Electric frequency modulation radio receivers and transmitters (operating on 158.175 mc.), power apparatus to operate from 32-volt and 64-volt d-c and 117-volt a-c supplies as well as control units, antennas, and test apparatus. Tests were made of end to end, train to train, front to helper locomotive, and train to wayside communication in the Cascade Mountain territory of Washington State. Good results were obtained throughout the test runs. Then the mobile equipment, in charge of G. R. Frost, was sent to San Francisco, where further experiments were conducted.

On May 21 what is believed to be the first transcontinental telephone calls from a moving locomotive were made between the San Francisco area and New York City. Bell Telephone Laboratories, in collaboration with The Pacific Telephone and Telegraph Company, the A T & T, and Western Electric, are conducting experiments on radio telephone service with the Southern Pacific Railroad in the San Francisco yard area. The service connected into the general

Command post of a yard crew is the rear step of the tender. At the telephone is G. R. Frost of the Laboratories

wire telephone system and, with no special hookup of any sort, calls were placed to the Laboratories and to the A T & T headquarters. At San Francisco, Mr. Frost, G. M. Smith of A T & T, R. T. MacFarland of Western Electric and Mr. Murphy of the Southern Pacific Railroad conversed with A. B. Clark and others at the Laboratories, and with F. M. Ryan and others at 195 Broadway. The locomotive on which the men were riding was about twelve miles south of San Francisco at the time the calls were placed.

News Notes

O. E. Buckley attended the Bell System Presidents' conference, April 30 to May 2, at the Waldorf-Astoria Hotel in New York. He testified in the Michigan State Rate Case on May 3 in Lansing.

William Fondiller was guest speaker on May 17 at the annual dinner of the Engineering Alumni of City College at the George Washington Hotel in New York City. *The Engineer in the Post-War World* was the subject of Mr. Fondiller's talk.

D. A. Quarles attended the A.I.E.E. Board of Directors meeting on May 14 in Asheville, N. C., and on May 16 and 17 visited the new Specialty Products plants of Western Electric at Winston-Salem and at Burlington, N. C.

Harvey Fletcher attended meetings of the National Academy of Sciences from April 22 to 24 in Washington; the American Physical Society from April 25 to 27 in Cambridge, Mass.; the Acoustical Society of America on May 10 and 11 in New York; and the American Otological Society on May 31 and June 1 in Chicago. At the Acoustical Society meeting of May 11 Dr. Fletcher was chairman of the session devoted to *Speech and Hearing;* while at the American Otological Society meeting he summed up talks of the Symposium on Hearing Aids. On May 16 and 17 he attended the George Westinghouse Centennial Forum at Pittsburgh, and on May 25 gave the Fifteenth Joseph Henry Lecture before the Philosophical Society of Washington at the United States National Museum. *The Pitch, Loudness and Quality of Musical Tones* was the subject of Dr. Fletcher's talk.

E. I. Green, H. J. Fisher and J. G. Ferguson are authors of a paper, *Techniques and Facilities for Microwave Radar Testing,* which was published in the May 1946 issue of *Electrical Engineering.*

M. B. Gardner discussed problems of hearing with Dr. Kobrak and Dr. Perlman of the Department of Surgery at the University of Chicago. On May 31 and June 1, Mr. Gardner attended meetings of the American Otological Society in Chicago.

W. B. Snow, at New London, received, on behalf of the Laboratories, A. L. Thuras' posthumous award from the Navy for Distinguished Civilian Service.

J. A. Hornbeck and Herman Feshback presented a paper, *Scattering and Absorption of High Voltage X-Rays in Steel,* at the American Physical Society meeting on April 25-27 at Cambridge, Mass. At the same meeting, C. H. Townes presented a paper, *Interpretation of Cosmic Noise—Radio Waves from Extraterrestrial Sources.*

W. H. Brattain and G. L. Pearson visited the Physics Laboratory at Purdue University, and G. W. Willard and J. M. Richardson, the Physics Laboratory at Brown University.

W. P. Mason spoke on *Supersonics* at the Physics Colloquium at Brown University, and C. H. Townes on *The Microwave Spectrum of Ammonia* at the Physics Colloquium at the University of Pennsylvania.

Elizabeth J. Armstrong has been appointed Acting Secretary of the American Society for X-rays and Electron Diffraction.

W. L. Heard's article on *Coördinated Symbols* was published in the May, 1946, *Industrial Standardization.*

K. K. Darrow addressed the May 1 meeting of the A.I.E.E., Nebraska section, at Omaha on the subject *Nuclear Energy—the Hope and Fear of the World.*

I. L. Hopkins was at Hawthorne during the week of May 13 on problems connected with hard rubber.

B. E. Stevens' trip to Haverhill was in regard to the manufacture of transformers and retardation coils.

"The Telephone Hour"

NBC, Monday Nights, 9:00 p.m.

July 1	*Nelson Eddy**
July 8	*Agnes Davis and Walter Cassel*
July 15	*Tito Guizar**
July 22	*Lily Pons*
July 29	*Jascha Heifetz*

* Broadcast from Hollywood.

Retirements

Among recent retirements from the Laboratories under the Retirement Age Rule were Theodore Muhlenbeck on June 30 with 34 years of service; James McInerney on May 31, 28 years; and Samuel A. Milne on June 30, 26 years.

Samuel A. Milne

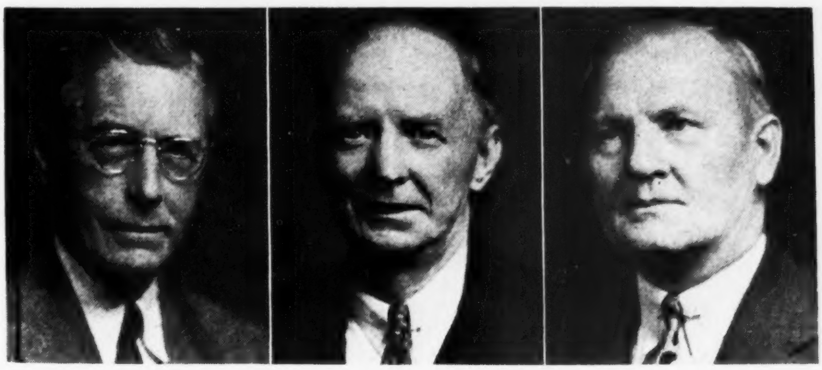
Before coming to the Laboratories in 1920, Mr. Milne had spent sixteen years as a catalog illustrator for the Mergenthaler Linotype Company in Brooklyn. He joined the Patent Department as a draftsman and then, in 1926, became Chief Draftsman in charge of the group. His responsibilities included the supervision of all the drafting and patent marking associated with the patent phases of the Laboratories work. Mr. Milne was also called upon in certain court proceedings to aid in the preparation of drawings, sketches and exhibits used in the presentation of testimony.

James McInerney

For his first sixteen years of Bell System service, Mr. McInerney was an electrician's helper in the Plant Shop. Then, during the early Thirties, he transferred to the Plant Operation Department as a night watchman and later on became a uniformed watchman. One of his daughters, Catherine, works in the blueprint group of the General Service Department.

Theodore Muhlenbeck

Mr. Muhlenbeck of the Switching Apparatus Development Department joined the model shop of the Western Electric Company in 1912 but soon transferred to the Apparatus Branch on the development and adjustment of the semi-mechanical panel apparatus installed in Newark. During the installation period he trained other men on the adjustment and maintenance of the system. Returning to West Street, he adjusted and maintained a 600-line step-by-step system. He continued in the apparatus group until his retirement and was on the testing and development of panel, step-by-step and crossbar apparatus.



S. A. Milne   James McInerney   T. Muhlenbeck

News Notes

F. E. Haworth has been appointed to The Joint Committee on Chemical Analysis by X-ray Diffraction Methods of the American Society for X-ray and Electron Diffraction and the A.S.T.M.

At the spring meeting of the A.S.T.M. in Pittsburgh, W. E. Campbell presented a paper *Tracking Troubles in Atmospheric Corrosion Testing* of which he is co-author with P. S. Olmstead and H. G. Romig. Mr. Campbell also spoke on *Carbon Brush Wear* at the colloquium of Research Department of the General Electric Company in Schenectady.

R. M. Burns, G. T. Kohman, M. D. Rigterink, J. R. Fisher and A. W. Treptow attended the American Ceramic Society's annual meeting in Buffalo. Mr. Rigterink presented two papers at the meeting, *Alkaline Earth Porcelain Possessing Low Dielectric Loss,* with R. O. Grisdale as co-author, and *Microscopic and X-ray Investigation of Some Steatite Bodies.*

F. F. Lucas gave an address on May 1 before the Rhode Island Chapter of the American Society for Metals at Providence.

C. S. Fuller spoke on *The Structure and Properties of Synthetic Plastics* before the research group of the General Laboratories of the United States Rubber Co. in Passaic.

G. N. Vacca has been elected treasurer and B. S. Biggs, C. J. Frosch and C. S. Fuller councilors by the North Jersey Section of the American Chemical Society.

E. T. Hoch went to Haverhill to study magnetic materials for repeating coils.

J. R. Weeks, H. G. Wehe and A. M. Wagner of Western Electric arranged at Red Bank for the shipment to Hawthorne of German equipment for making metalized condenser paper.

J. H. Bower attended a meeting of Sub-Committee C-18 of the American Standards Association on Dry Batteries, held in the Bureau of Standards, Washington.

L. F. Koerner conferred on quartz crystals at the Naval Research Laboratory, Washington. Mr. Koerner was also in Mansfield, Ohio, where he discussed thermostats for quartz crystal ovens with Westinghouse engineers.

J. M. Jackson attended the Long Lines' Splicers' School in Morristown for a month.

F. J. Given visited the Sprague Company at North Adams, Mass., to discuss capacitors for the rural power line carrier telephone system. Mr. Given, with R. W. DeMonte, A. B. Haines, E. A. Potter of the Laboratories and C. J. Gustafson and H. A. Koepp of Western Electric, discussed at Red Bank proposed JAN specifications on transformers and inductors.

N. Botsford and W. R. Neisser were at St. Paul and Hawthorne in connection with induction coils.

M. C. Wooley witnessed the manufacturing trial at Hawthorne of aluminum can central office condensers.

M. W. Bowker spent two weeks in Joliet, Ill., in connection with the training of cable men in pressure testing and maintenance of gas-filled toll cables.

V. H. Baillard observed the maintenance training of coaxial cable splicers at Richmond where he also discussed the suitability of special splicing tools provided for coaxial cables.

W. C. Kleinfelder spent several weeks in Dallas and Mineral Wells, Texas, observing the preparation and protection of splices in buried copper-jacketed coaxials.

R. G. Koontz and W. O. Wagenseil, with W. R. Hummel and L. E. Davis of Western Electric, discussed with members of the Association of American Railroads in Chicago, on May 10, vibration and shock problems involved in railroad transportation of telephone equipment.

D. S. Myers, in Detroit, is inspecting a trial installation of a new type of auxiliary framing which will appreciably reduce the use of steel in the overhead structure supporting dial frames.

A. J. Wier and P. T. Haury conferred at the Western Electric Company plant in Haverhill on problems of K-carrier crosstalk-balancing equipment. They also discussed carrier projects with engineers of the New England Telephone and Telegraph Co.

P. T. Sproul and R. H. Daugherty of A T & T made a trip to Pittsburgh to establish a new video circuit.

C. Breen, O. H. Williford, H. W. Heimbach and A. A. Mayer, at Hawthorne, observed shop testing methods and procedures employed in the manufacture of equipment used in new No. 5 crossbar telephone switching system.

K. L. Maurer and Robert Pope were in Pittsburgh on May 3 to discuss investigation of cathodic corrosion on underground cable sheaths. From May 7 to 9 they attended the annual convention of the National Association of Corrosion Engineers in Kansas City.

J. W. Corwin discussed, at Hawthorne, problems connected with the steel shortage.

G. S. Bishop, L. J. Scott and D. H. Wetherell were in Philadelphia on No. 4 toll office problems.

H. W. Heimbach discussed with engineers at Hawthorne problems concerning the No. 5 crossbar telephone switching system.

E. T. Ball and F. W. White, at the Dahlstrom Metallic Door Company, Jamestown, N. Y., consulted on the new framework for the No. 5 crossbar system.

V. T. Callahan discussed diesel and gasoline engine automatic sets at General Motors Corporation, Detroit; at the Duplex Truck Company, Lansing; and at Hercules Motors Corporation, Canton, Ohio.

H. T. Langabeer, at Hawthorne, studied the allocation of motor generator sets.

On a battery inspection tour, F. T. Forster visited The Bell Telephone Company of Pennsylvania at Altoona, and the Long Lines at Meriden, Conn.

E. H. Gilson and W. L. Gaines, in Atlanta, installed an automatic cathode-ray oscillograph for recording voltages caused by natural lightning in the Atlanta-Meridian copper-jacketed coaxial.

J. Mallett and R. H. Ricker attended an S.A.E. committee meeting on May 22 in Detroit relative to the installation of radio equipment in vehicles.

C. M. Harris discussed a new mathematical formula applicable to the treatment of acoustics in the theater before the Acoustical Society of America on May 10.

P. P. Debye is author of a paper, *A Photoelectric Instrument for Light Scattering Measurements and a Differential Refractometer*, published in the May, 1946, *Journal of Applied Physics.*

M. B. McDavitt, F. J. Singer, C. C. Taylor, D. Mitchell and L. A. Dorff were in New Haven to discuss the highway mobile radio program with engineers of A T & T, Western Electric, The Southern New England and New York Telephone Companies.

G. R. Frost has been in San Francisco for the past month on mobile radio matters.

S. B. Wright and Stephen Duma are at Cheyenne Wells, Colorado, on the rural radio-telephone project described on page 269.

F. J. Skinner discussed equipment supplied for mobile radio-telephone service at the Galvin Corporation in Chicago.

A. C. Peterson spoke on *Urban Mobile Radio-Telephone Systems* in St. Louis on May 23 at the I.R.E. sectional meeting.

Doren Mitchell and W. R. Young demonstrated the urban mobile radio-telephone system in St. Louis on May 15 to representatives of the press and to broadcasting companies.

F. B. Llewellyn, President of the I.R.E., presented a paper, *Charting the Course of the I.R.E.*, at the June 5 meeting of the New York section.

Papers presented at the joint U.R.S.I.-I.R.E. meeting on May 3 and 4 at Washington included *Microwave Antenna Measurements* by C. C. Cutler, A. P. King and W. E. Kock; *A Method for Calibrating Microwave Wave Meters*, by L. E. Hunt; and *Parabolic Antenna Design for Microwaves* by C. C. Cutler. Others who attended were J. C. Schelling, W. M. Goodall, K. Bullington and F. H. Willis.

Please put your RECORD in the "Correspondence-Out" box when you are through with it so that it can be sent to a Serviceman's family.

July Service Anniversaries of Members of the Laboratories

40 years

Denis Cronin
O. M. Glunt
W. F. Mayes
A. S. Page

35 years

R. E. Alberts
B. E. Behrens
W. E. Darrow
John Davidson, Jr.
E. S. Gibson
R. C. Jones
R. L. Jones
W. H. Martin
S. C. Miller
T. J. Murtha
A. L. Richey

30 years

L. L. Bouton
J. A. Burwell
R. E. Curran
H. W. Dippel
J. G. Ferguson
B. H. Jackson
A. G. Jeffery
R. T. Jenkins
A. A. Oswald
G. C. Reier
D. F. Seacord
H. F. Shoffstall
H. L. Walter

25 years

Hermann Alfke
H. S. Black
R. L. Case
Wendel Cernik
A. J. Christopher
W. H. Edwards
O. C. Eliason
H. A. Etheridge, Jr.
T. C. Henneberger
E. J. Kane
R. E. Keim
G. V. King
A. G. Laird
R. S. Leonard
Hazel Mayhew
C. G. McCormick
B. A. Merrick
V. M. Meserve
Andrew Mogilski
D. L. Moody
W. J. Pinckney
K. F. Rodgers
J. T. Schott
N. R. Stryker
Allan Weaver
H. M. Yates
A. W. Ziegler

20 years

Emma Allen
E. E. Arnold
Dorothy Barry
H. W. Bode
H. G. Boyle
A. T. Calvano
Frank Colantuoni
T. L. Dimond
D. W. Eitner
M. S. Glass
L. B. Hilton
F. W. Holland
Helen Johnson
R. P. Jutson
G. F. Kallensee
H. A. Lewis
C. E. Luffman
H. P. Lynch
Joseph Maurushat, Jr.
K. H. Muller
J. L. Murphy
C. R. Noble
A. F. Noe
W. T. Rea
J. F. Riordan
Frieda Schultz
J. H. Shuhart
C. F. Smith
F. R. Stansel
W. R. Steeneck
E. E. Szymanski
N. H. Thorn
D. E. Trucksess
P. W. Wadsworth
Karl Wittmann

15 years

J. J. Carroll
R. C. Gee
C. A. Naughton
R. C. Platow
F. M. Tylee
C. A. Warren

10 years

F. S. Best
B. S. Biggs
F. J. Biondi
H. A. Birdsall
E. E. Birgir
J. J. Boese
W. H. Boghosian
D. C. Bomberger
Felix Braga
Muriel Cadmus
J. J. Cremins
J. F. Daly
R. V. Dean
F. E. De Motte
C. H. Elmendorf
G. R. Frantz
J. L. Garrison
Henry Henkel
C. C. Houtz
G. D. Johnson
Lorraine Josephson
Marie Kummer
John Lavelle
Nean Lund
R. W. Marshall
J. J. Martiner
F. E. Radcliffe
J. M. Sullivan
W. O. Wagenseil
Catherine Weiland

L. C. Swicker has been at Hawthorne in connection with the introduction of pulp insulation on 19-gauge cable.

R. H. Colley discussed present pole problems with representatives of the engineering and plant groups of The Mountain States Telephone Company at Denver. Dr. Colley presented a paper on *Non-Pressure Submersion Treatments of Lodgepole Pine Poles* at the convention of the American Wood Preservers' Association held in Cincinnati from April 22 to 24. The convention was also attended by G. Q. Lumsden and C. H. Amadon, who presented to the convention the report of the Committee on Pole Service Records.

C. H. Amadon completed a preliminary survey of treating practices at Douglas fir and lodgepole pine pole plants in the territories of The Pacific and Mountain States Telephone Companies.

C. D. Hocker and B. A. Merrick witnessed a field trial of cable lashing machines at the Southwestern Bell Telephone Company in St. Louis.

C. C. Lawson, A. H. Hearn and T. A. Durkin discussed wire production problems at Point Breeze.

T. A. Durkin participated in inspections at Atlantic City of drop wires installed for New Jersey Bell Telephone Company service trials.

C. C. Lawson and C. S. Gordon conferred with Western Electric engineers at Kearny on measures looking to cotton yarn conservation in the manufacture of various types of wires and cables.

J. B. Hays travelled to Denver for discussions on lineman's test sets and to Dallas for discussions on coaxial testing.

Quality surveys of cable terminals by L. N. St. James and B. R. Eyth were attended by L. W. Kelsay at St. Paul from April 9 to 12, and by Mr. Kelsay and A. W. Dring at Baltimore on April 16 and 17.

C. Shafer and T. C. Henneberger consulted with engineers of The Bell of Pa. on problems of exchange cable maintenance.

G. W. Lees, Jr., has been appointed Murray Hill Service Manager, reporting to R. H. Wilson, General Service Manager, to succeed R. E. Merrifield, who resigned on May 31.

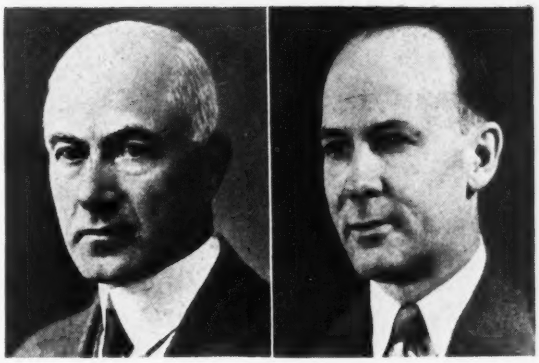
Harry B. Coxhead visited the White House to consult with the staff regarding communication matters.

Obituaries

Oscar F. Forsberg, a former member of the Technical Staff who retired in 1933, died on May 13. Starting as a model maker in the Clinton Street shop of the Western Electric Company in 1900, he came to New York seven years later, and in 1913 entered what is now the Switching Apparatus Department of the Laboratories. An excellent mechanical designer, he made many contributions to the telephone art, and over a period of years had under his supervision development work on both station and central-office apparatus, the latter including panel, step-by-step and crossbar apparatus design. In 1930 he was one of a group of five members of the Laboratories who visited telephone companies and manufacturing plants in Europe to observe operating practices, equipment and new developments in the communication industry abroad.

* * * * *

Alexander N. Jeffries, a member of the Technical Staff in the Quality Assurance Department, died on June 6. Mr. Jeffries was graduated from the University of Tennessee in 1914 with the degree of B.S. in Electrical Engineering, and immediately joined the student course of the Western Electric Company at Hawthorne. He then spent one year in the development of miscellaneous central-office apparatus and one year on repeating and loading coils. In 1917 he came to New York where he continued his work on the design and development of loading coils. A year later Mr. Jeffries transferred to the division engineer's office of the Northwestern Bell Telephone Company at Minneapolis on equipment engineering. Early in 1920 he entered the Engineering Inspection Department at Hawthorne. When this department was reorganized in 1924, he returned to West Street where he dealt first with investigations of complaints on special apparatus and later became head of the Complaint Bureau of the Quality Assurance Department. For the past several years he had been in charge of the switching apparatus section of the central-office quality engineering group.



O. F. Forsberg 1870-1946 A. N. Jeffries 1892-1946

* * * * *

John F. Dalton, a technical assistant in the Transmission Apparatus Development Department, died on May 21. Mr. Dalton joined the Central Instrument Bureau in January, 1944, and then, six months later, transferred to the electrical measurements group to test preproduction lots of magnetic locators used primarily for submerged mines and torpedoes. This was followed by several months devoted to testing power transformers for war purposes. Just prior to his death he was again assigned to the testing of magnetic locators.

J. F. Dalton 1913-1946 Josef Kosmol 1901-1946

* * * * *

Josef Kosmol of the Plant Department, with continuous service since 1928, died on May 20. Mr. Kosmol joined the building shop group as a pipefitter and became a group supervisor in 1941. He had supervised several of the large changes in the West Street building and had also been closely associated with the piping system for handling gases under pressure used by the Electronic Apparatus Development Department in Building T.


MAJOR POPE


RALPH NELSEN


H. G. REIMELS


THOS. FOX, JR.


P. S. BENNETT


H. H. HOFFMAN

A Welcome to Sixty-Four Veterans

Major Theodore N. Pope has returned from the Pacific theater of war where he served as Assistant Signal Officer of an Anti-Aircraft Artillery Command and on the Staff of the Signal Officer of the middle Pacific area. Before going overseas, Major Pope had successfully completed several assignments in the Office of the Chief Signal Officer in Washington. Later, as Assistant Chief of the Packaging Division, he had been occupied in developing packaging methods for electronic equipment to prevent damage in transit and deterioration due to climatic conditions, and he had organized and headed the Joint Army-Navy Committee on Electron Tube Packaging.

Ralph Nelsen, trained at Camp Crowder and at the B.T.L. School for War Training, installed, operated and maintained secret equipment at the Pentagon Building and for fourteen months at Guam, where he earned a battle star.

Harry G. Reimels, of the Field Artillery, was a computer for 20-mm howitzers during fourteen months of Pacific duty with the 6th Army.

Thomas Fox, Jr., taught *Principles of Electricity* at the Eastern and at the Central Signal Corps Schools during his three years of Army service.

Patrick S. Bennett, as Messenger Sender Chief, served in the E.T.O. on the continent with the Engineers. Prior to that he had attended the A.S.T.P. at Clemson College.

Harold H. Hoffman received a personal leave of absence to study with the Signal Corps before he went on military leave. Later, as member of a five-man team, he installed and maintained microwave type units on the island of Oahu.

Edward L. Fischer was attached to the 4025 Signal Service Group as supervisor in a radio teletype relay station, and served with that outfit in Australia and New Guinea.

Warren J. Goldstein, a machinist mate 2/c, served on a fleet oiler in the Pacific and in the Philippines during most of his naval career.

Nicholas J. Flynn had thirty-one months of sea duty while serving with the Coast Guard as boatswain mate 2/c, first on a cutter on the Iceland patrol, then on a transport in Pacific waters and, for his final assignment, on a destroyer escort.

Lieut. Milton Dudeck, who began his military career as a radar mechanic, went to O.C.S., was graduated as a ground radar officer and was then assigned to Camp Pinedale, California.

Eugene A. Kleiner, during his eighteen months in the Navy, worked as a machinist at the Mine Warfare Test Station in Solomons, Md., doing experimental work on Laboratories' developments.

Harold W. Kowal has returned to work in the Drafting Department at the Whippany Laboratory. He spent fourteen months as rifleman instructor at Camp Fannin and he also served at Camp Robinson, Arkansas, as non-commissioned instructor.

Lieut. Col. C. R. Brearty entered OCSigO in 1942 and participated in forming the Signal Corps Inspection Agency. He served as OC of the Quality Control Section of this agency until March, 1945. During this period he prepared and issued the Signal Corps Inspection Manual and was instrumental in introducing quality control procedures of the types developed by G. D. Edwards, H. F. Dodge, H. G. Romig and G. R. Gause of the Laboratories, into the Signal Corps inspection of radio, radar and other equipment being procured. In March, 1945, he was advanced to the position of OC Inspection Plans Branch of the Agency, becoming responsible for procedures employed in all inspection activities of the Agency. After V-J Day he participated in planning the peacetime Signal Corps inspection organization.

E. L. FISCHER

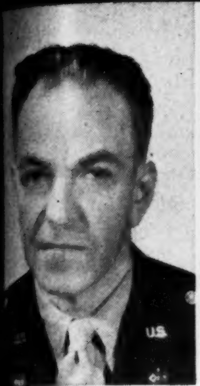
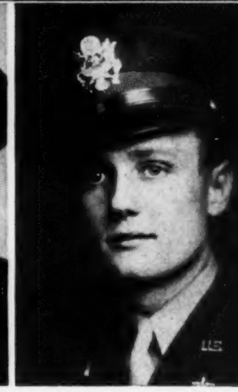

W. J. GOLDSTEIN


N. J. FLYNN


LIEUT. DUDECK


E. A. KLEINER


H. W. KOWAL

Lt. Col. Brearty Lt. Col. Guerci A. F. Bartinelli Lt. Cmdr. Clutts Lt. Norton G. J. McArdle

Lieut. Col. Harold B. Guerci, while assigned to the Eastern Defense Command, assisted in planning the military communications network within and between the principal east coast cities defended by anti-aircraft in the early days of the war, and was later assigned an anti-aircraft unit in Buffalo. After studying radar applications in Florida, he was sent overseas and placed in charge of the collection and dissemination of warning of the approach of flying bombs directed against the port of Antwerp—this radar data being utilized by anti-aircraft units employed in their destruction. He was assigned the same duties in the protection of the Rhine River crossings.

Andrew F. Bartinelli was awarded the Purple Heart and the Bronze Star Medal "for heroic achievement in action" at Leghorn, where he was wounded by shell fragments while fighting with the 133rd Infantry of the 34th Division.

Lieut. Comdr. Charles E. Clutts, upon entering the Navy in 1944, was assigned to the Electronic Division of the Bureau of Ships and was stationed in Washington. As officer-in-charge of a section dealing with publications and training literature, Comdr. Clutts was responsible for the quality and distribution of manufacturers' instruction books for electronic equipment as well as the numerous books and periodicals published by the Navy itself. He was later transferred to the Administrative Division of the Bureau's publications, ranging from machinery and shipbuilding to minesweeping and electronics. This is the second time Mr. Clutts has been in the Navy—a previous commission having been resigned in 1929.

Lieut. Robert L. Norton, who was awarded the Purple Heart, flew B-26 medium bombers on seventeen missions over Germany. On his 12th mission he crashed into a bomb crater, was hospitalized but later flew five more missions.

George J. McArdle received the Purple Heart as the result of a torpedoing outside of Cherbourg. After fighting through France, Belgium, Germany and Austria, he was assigned to the Inspector General's Office to inspect signal equipment.

Merle I. Hampton was accorded two long trips during his Army service—one to Germany with the 3rd Engineers and the other by way of the Panama Canal and New Guinea to Northern Luzon.

Joseph A. Ceonzo, a soundman or a "ping jockey," aboard the destroyer escort *Powell* and the destroyer *McCormick*, maintained and operated sound gear, tracked and attacked submarines, in the Atlantic and Pacific theaters of war.

Robert F. Graham's tour of naval duty was in various radio and radar schools throughout the United States.

Lieut. Philip H. Thayer, who was assigned to the Electronic Field Service Group of the Naval Research Laboratory, Washington, during the war, travelled aboard ship with new fire-control shipborne radar during shakedown cruises and post shakedowns to insure that crews were properly trained and the electronic gear in satisfactory order.

Lieut. Edwin E. Birger, of Apparatus Development Drafting, was first assigned as a navigator, but after further training became a radar operator assigned to B-25's.

James B. Kennedy studied at the Laboratories School for War Training in connection with secret equipment to which he was later assigned in the Pentagon Building. He also served fifteen months on Guam.

William L. Vedera in the Army did work similar to what he now does as a Technical Assistant at the Laboratories. An instrument repairman in the 6th Army, his tour of duty was from New Guinea via the Philippines to Tokyo.

Hans W. Menzel is again glass blowing in Building T after having served in Australia, New Guinea, and the Philippines. As a Signal Corps man engaged in airborne radar, he was attached to the Far Eastern Service Command Air Forces.

M. I. Hampton J. A. Ceonzo R. F. Graham Lt. Thayer Lt. Birger J. B. Kennedy






J. M. REUTER R. F. LOGAN JEAN NALLY JEAN SANDERSON ELIZABETH KENNY G. F. BOYLE

John M. Reuter had twenty-seven months of island duty in the South Pacific to his credit. A radioman on PT boats for twenty-three months and later on a P-7 tender, he fought from Munda through to the Philippines and Okinawa. He was also land based on Bougainville.

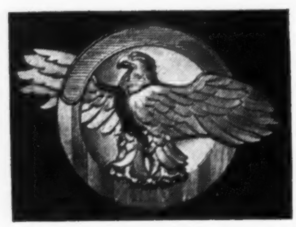
Robert F. Logan of the Marines wore one battle star and a Presidential Unit Citation when he returned to this country to attend Communications School. He had been in New Caledonia and Guadalcanal with communications personnel and had participated in the invasion of Guam before he was sent to Camp Lejeune, where he studied until released from service.

Jean R. Nally spent almost two years in the Waves. After boot training she was assigned to Naval Hospitals in Maryland and Pennsylvania. At the time of her discharge she was a technician in charge of the naval electrocardiograph department at Philadelphia.

Jean Sanderson joined the Marine Corps in April, 1944. She trained at the Aviation Machinist Mate School at Norman, Oklahoma, and then was assigned to servicing planes in North Carolina.

Elizabeth P. Kenny, Sp/G 1/C, in two years of naval service, was stationed at Quonset Point, R. I., where she taught aerial gunnery to aircrewmen who were to fly in Avengers or Helldivers, and at Groton, N.A.S., where, in addition to instructing, she worked in the Recognition Department of that base.

Guy F. Boyle served two and one-half years in the Marine Corps, eighteen months of which were spent in the Asiatic-Pacific area. In the Okinawa campaign he was engaged in the maintenance of small arms equipment.



The Laboratories has employed 989 veterans of World War II

Roland M. Scheller spent nearly two years in the South Pacific maintaining and repairing ack-ack equipment with the 25th Ordnance Anti-Aircraft Company. On January 1, 1946, he played with the Ack-Pack Football Team in the Pacific Olympics in the Bamboo Bowl, Manila.

Robert C. Kuenstner spent more than a year on the *Poseidon,* a radio repair ship, in the Pacific theater of operations, seven months of which were in the vicinity of Okinawa. He was also instructor in radio theory at the Amphibious Training Base in Solomons, Maryland.

Robert H. Canton, of the Development Shop, was overseas a year and a half with the 4025 Signal Service Group, and in that time maintained and repaired communications equipment from New Guinea to Tokyo.

Benjamin P. Ransom maintained and repaired radar, radio and sound equipment on the minesweeper *Staff*. He served during the invasions of Normandy and Southern France and at Okinawa.

Joseph C. Berka's responsibility on the island of Oahu for all twenty-five months of his overseas duty was in maintaining and servicing batteries of M9 and M10 Gun Directors. For the first year he was alone in the work but later, as batteries increased, he became chief of section.

Eric G. Strubing, of the Navy, was land based at Subic Bay in the Philippines and later served on the LCI 611 in Shanghai on a river patrol.

Martin C. Nielson was on special assignment with the Signal Corps and received some of his training at the Laboratories School for War Training, where he took a course in electronics. After being assigned to Ft. Myer, Virginia, he shipped out with the Navy to the Marianas and Guam.

R. M. SCHELLER R. C. KUENSTNER R. H. CANTON B. P. RANSOM J. C. BERKA E. G. STRUBING





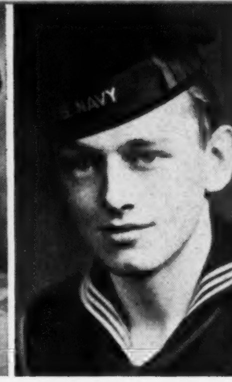


M. C. Nielson


F. R. Merritt


Lt. Lundquist


E. A. Pasanen


T. E. Bailey


Lt. Suneson

Francis R. Merritt graduated from the Laboratories School for War Training and spent fifteen months in the Pacific theater of operations. At Guam he was in charge of a shift of men working on the installation, maintenance and repair of communications equipment.

Lieut. Clifford J. Lundquist served in two theaters of war, first in the Mediterranean on the U.S.S. *Kettle Creek* and later in the Pacific on the U.S.S. *Cayuse*. After being hospitalized in Australia, he was returned home and, shortly thereafter, released from the maritime service.

Eino A. Pasanen spent twenty-six months as a radio mechanic in a signal air warning battalion with the 9th Air Force in Europe and is entitled to wear the Belgian Fourregere.

Thomas E. Bailey studied at Colgate University as a naval air cadet; at Bainbridge, Md., under the Navy V-6 program; and at Yale University under the V-12 program.

Lieut. Austin R. Suneson, when he first joined the Merchant Marine, lived through a harrowing trip to Murmansk, Russia. Once home, he joined the Merchant Marine Academy, was graduated and then served in the Navy as senior assistant engineering officer on oilers in the South Pacific.

John J. Downes, after basic infantry training, was assigned to Camp Pickett until he was released from service.

Henry S. Loeber was a naval air cadet for thirteen months before being assigned to repair the airborne radar on planes aboard escort carriers, first on the U.S.S. *Bairoka,* and then on the U.S.S. *Matanikau* and on the U.S.S. *Core,* which is credited with five submarines.

Eugene Miritello spent seventeen months of duty in the Pacific theater of war as a cryptographic technician with the 67th Signal Battalion, attached to Afwespac.

Lieut. Maywood K. Asdal spent most of his naval career at the Yorktown, Va., Naval Mine Depot working with various types of underwater ordnance. In connection with this, he travelled around the country correlating the activities at Yorktown with the production of naval underwater ordnance devices.

Lawson F. Cooper, a radio repairman on FM and AM radio equipment, served on Saipan and Okinawa with the Communications Section, 1882nd Engineer Aviation Battalion attached to the 20th Air Force and later to the Far Eastern Air Forces.

Leaves of Absence

As of May 31, there had been 1,051 military leaves of absence granted to members of the Laboratories. Of these, 711 have been completed. The 340 active leaves were divided as follows:

Army 155 **Navy 135** **Marines 12**

Women's Services 38

There were also 12 members on merchant marine leaves and 1 on personal leave for war work.

Recent Leaves

United States Army

John C. Herrera
Robert C. McCrystal
Peter G. Reuter

United States Navy

Robert J. Lynch
George Tishy

Robert G. Kemple fought with the 4th Marine Division on the Marianas and is entitled to wear the Presidential Unit Citation. He served first on Saipan and then on Tinian, and, after the latter was secured, returned again to Saipan.

J. Downes

Lt. Asdal

E. Miritello

H. S. Loeber

L. F. Cooper

R. G. Kemple

J. H. Devereaux W. Burhart C. D'Amico A. O. Schwarz W. A. Myles W. J. Schneider

John H. Devereaux trained at the Laboratories School for War Training for the work in which he engaged in the Pentagon Building; at Camp John T. Knight, California; in the I. G. Farben Building, the Pentagon of Germany; and in France.

Walter Burhart, in three years of naval duty, spent eight months at sea aboard the destroyer *William R. Rush* as a radio operator.

Carmen D'Amico handled communications from ship-to-shore on LCVP's, when the amphibious forces landed on Okinawa. He remained to set up towers for further ship-to-shore communications.

Alfred O. Schwarz spent twenty-nine months in the Navy. For more than two years he was overseas in the Admiralty Islands, first with a construction battalion and later as broadcast engineer in the Armed Forces Radio Services. Their broadcasts from the 350-watt transmitter aroused comment on several occasions from Tokyo Rose.

William A. Myles spent sixteen months in the Mediterranean theater, first as a rifleman with the Infantry, later with the Engineers and with the Signal Corps, where he was in charge of a German POW stockade.

William J. Schneider, as line chief with the 2nd Marine Air Wing, supervised the maintenance of F4U Corsairs in the Philippine-Okinawa area.

Robert W. Mann served as a cryptographic maintenance man in New Guinea and on Leyte and Luzon.

Rolf Dalane, a draftsman in the Commercial Products Development Department, was a carrier repeaterman with the 97th Signal Battalion and fought from France, through Belgium and Germany and into Czechoslovakia.

William M. Ehler, a radar technician with the 2nd Marine Air Wing, maintained, repaired and, on occasion, operated radar equipment during the eleven months he was on Okinawa.

Thomas Musca specialized in naval aerial photography and, after attending photographic school, was assigned to photographic laboratories at Patuxent River and at Quonset Point. He was also assigned to the U.S.S. *Franklin Delano Roosevelt* but did not sail on her.

George E. Fuchs is now with the wiring group at Chambers Street. One of his three years of Army service was spent on Okinawa, where he was a radio operator with the 3161 Signal Corps.

William Robertson received the Purple Heart for wounds received while fighting with the Infantry at Pistoia, Italy. For the rest of his military service he was a photographer assigned to the Signal Corps in Italy.

Joseph F. Mallon, of Whippany, served in two branches of the military services, first with the Seabees on a floating drydock in the South Pacific and later in the U. S. Maritime Service.

Paul A. Hopf's military assignments were at various naval stations along the east coast. Upon returning, he resumed his work in the General Service Department.

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Lieut. Col. Albert G. Kobylarz has been awarded the Army Commendation Ribbon for "superior performance" of duty as chief of Radar Branch, Communications Maintenance Section of the Air Technical Service Command. Col. Kobylarz, who is still on active duty at Wright Field as this issue goes to press, was concerned with the installation of special radar equipment in the B-29's which bombed Japan.

Francis X. Sullivan, a member of the Photographic Department, has been working in the prison office in Luzon, helping to make up shipping rosters of Japanese who are being returned to their homeland, assigning the men to ships and making up case histories of their return for file.

Capt. John F. T. Martin, now a member of the Laboratories at Whippany, was formerly an officer in radar development in the Signal Corps, attached to the Army Air Force.

R. W. Mann R. Dalane W. M. Ehler T. Musca G. E. Fuchs Wm. Robertson

   

 

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